THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE CONTINUITY OF SUPPLY.

THE effort of two associated electric power and supply companies in North Metropolitan districts to secure the insertion in their Bill of clauses prohibiting strikes of their employés has naturally been noted with widespread interest. Whether such an attempt is likely to eventuate as those responsible for it desire is quite another matter. The question is one of public interest and importance, for the supply of electricity is to-day the very life-blood of the community, especially where industries are dependent upon it as a driving power. Cut that supply off because of the grievances of, it may be, even a handful of men, and for the time being work comes to a standstill. Plunge a city into darkness, and chaos and confusion reign supreme. But the same thing has to be said regarding the operation of our railways and tramways, the supply of gas, water, telegraph and telephone, and other services, all forming essential factors in life to-day. There is undoubtedly here involved a question far too great to be fought for single-handed. If it affects one electric supply concern it affects all, and if Parliamentary action is called for in regard to one class of public service, it is required for others as well, as we have indicated. This being so, there should be strong united action rather than an isolated move, and those who have interests at stake should adopt organised movement for supporting the North Metropolitan action.

It is just as well thoroughly to weigh the probabilities in an agitation of this kind. We have had many a practical lesson during the last few years of the damaging effects of strikes, and there is a strong desire somehow or other to avoid them in the future. But there is perhaps an even stronger desire to ensure better pay and conditions for Labour, and the political temper must be taken into account in seeking Parliamentary authority. We opine that though a large number of electric supply systems are owned and controlled by municipalities in whose deliberations the Labour and Socialistic influences are sometimes very pronounced, there will be a desire to safeguard the interests of the public—the nominal owners of the undertakings—by ensuring an uninterrupted supply of electric light and power so far as contracts of service can be made to produce that result. Company undertakings will, no doubt, be completely unanimous in support of the idea, they being uninfluenced by such desires and sympathies as dictate so much of municipal policy in handling employés and labour generally.

The clause in question contains the following:—

Where any person employed by the two companies wilfully and maliciously breaks a contract of service with the two companies, knowing, or having reasonable cause to believe, that the probable consequence of his so doing, either alone or in combination with others, will be to deprive the inhabitants of a city, borough, town, or place within the area of supply of the two companies wholly, or to a great extent, of their supply of electricity, he shall, on conviction thereof by a court of summary jurisdiction, or on indictment, as hereinafter mentioned, be liable to pay a penalty not exceeding £20, or to be imprisoned for a term not exceeding three months, with or without hard labour.

It will naturally be wondered by some of our readers whether this clause is framed as a definite counterblast to the adoption of a militant policy by the recently organised association of station engineers. We have always sympathised with legitimate efforts to improve the status and pay of employés of this class, and we have been gratified to note the better tendency that has prevailed of late. We should be the last to advocate a strike policy for supply station men, but we can, to some extent, understand that when their other efforts to secure redress for their grievances are found to be of no avail, they are tempted, in this age of labour unrest, to indulge in threats. It may be that Parliamentary Committees, before they impose clauses making it penal to withhold service from electric supply undertakings, will require to know something about the conditions, salaries, and rates of wages of those whom it is desired to penalise. If central-station men are underpaid there will then be an opportunity to remedy that deficiency in exchange for the burden of penalty, and so simultaneously there may also disappear the grievance which gave rise to the necessity for seeking Parliamentary prohibition.

Of course in what we have said we are concerned with all electric supply undertakings and not merely with the one which happens to be responsible for the present application. To maintain the continuity of electric supply at all costs is an imperative necessity; but there is a strong moral obligation resting upon those responsible for electrical undertakings to see that remuneration of electrically-trained men is fair and reasonable for the class of services rendered.

Hull Telephones.

THE Hull City Council at a special meeting on the 5th inst. decided to purchase from the Post Office the plant of the late National Telephone Co. in the Hull area, at a price of £193,000. An application will be made to the Postmaster-General for a licence for 21 years as from January 1st, 1912, and also to the Local Government Board for the necessary borrowing powers.

Comment on the decision of a City Council to extend municipal activities is unnecessary, and the decision to purchase need not occasion surprise. But what is to be said about the Postmaster-General agreeing to the sale of this plant? The wisdom of Governmental management of telephones was always doubted by a large section of the community, and their numbers have increased of late; but there was little difference of opinion on the point that the telephone was not suited to municipal working.

Many opponents of Government purchase were reconciled thereto by the arguments favouring unity of control, local and trunk, throughout the kingdom. And now the Postmaster-General turns his back upon all these arguments, throws over the only principle that had solid weight, and permits an isolated service in a limited area to remain in other hands! And this at a time when it seemed as if there was some enlightenment on the drawbacks of embarking on public service enterprises on a parochial scale! We await with interest the explanations that may be offered. Meantime, we can only congratulate Hull on the pertinacity, or some other peculiar propensity, which has enabled it to bring about such a result. We cannot congratulate it on the result, for we believe that what it assumes to be an advantage is a serious drawback.

The Next Electrical Exhibition.

WE have received a number of inquiries respecting the date of the next electrical exhibition. Some of our correspondents are erroneously under the impression that there is some rule or other in force requiring that such events be organised by the trade itself every three years. There were many discussions years ago as to the right period that should be allowed to elapse between big electrical displays, and opinion was strikingly divided. Some did not believe in exhibitions at all, others thought once in five years was the correct thing, others wanted the triennial event, while there are yet others who —possibly because of the particular nature of their manufactures—see merit in yearly display.

Now, in order once for all to set the minds of our questioners and others at rest, we have ascertained the official B.E.A.M.A. policy, and we have received due authority to state that the matter has, of course, been under consideration at times during the past year, but it has been resolved not to hold an exhibition during 1914, and possibly not in 1915.

The reader is aware from notices that have already appeared in these pages that a special effort is being made to secure a representative exhibit of electrical manufactures, &c., at the Anglo-American Exhibition at the White City, and that a big exhibition is to be held at Nottingham; there will also, doubtless, be a number of local electrical shows. These will provide opportunities for firms who are anxious to keep themselves and their wares right before the public eye. All we desire to intimate to the trade generally at this juncture, however, is that there will be no big electrical exhibition organised by the B.E.A.M.A. yet awhile.

Lead.

AFTER a period of temporary hesitation and a downward tendency in prices a short time ago, which at intervals were rather strongly defined, the market has taken a distinctly better appearance, and there has since last writing been a decided improvement in the demand from certain of the oversea markets, notably Russia. The strength of the demand from this quarter for many months now has been one of the most striking features of the situation, and it testifies to the growth of industrial activity in that country, especially in the iron and steel trades, which continues, regardless of the reactionary tendencies at work in other directions. The general trade demand for lead has also been quite good, especially when the recent all-round slackness is taken into consideration, and the heavy quantities which have been coming forward recently have all been required, the arrivals in consequence passing off without any indications of congestion. There was some little time ago a disposition to take rather a poor view of the market, and this encouraged a fair amount of bear selling, under which prices reacted downwards sharply, but the inclination within the last week or two has been in the direction of covering oversold commitments, a task rendered not too easy by the firm attitude of the leading interests, whose policy has been rather in the direction of supporting prices than of putting metal forward on offer. There is no falling off in the quantities coming forward, but at the same time there is, as has been indicated, no pressure to sell, and the outlook seems fairly good. Of course, these are not times for booms to be initiated, and there is very little chance of prices going back to the best levels of last year, but at the same time there is at present no room for exaggerated pessimism, and the chances are that the metal becoming available will pass into the hands of the trade without difficulty at around to-day's rates. The more acute phases of the 1913 scarcity have passed, and it is clear that when once Mexico assumes a more settled appearance, and shipments are resumed, prices will be liable to undergo a scaling down process. As it is, however, there

seems to be not the smallest chance of the Mexican trouble subsiding for months to come, and meantime the lead trade has accustomed itself, to a very large extent, to doing without metal from the scene of civil strife which has temporarily paralysed industrial operations in one of the most richly mineralised countries of the world. An encouraging feature is the steady buying for forward shipment which has been going on.

The extreme prices touched in the past year were £21 10s. and £15 7s. 6d., while the average for the 12 months was £18 6s. 2d., which compares with £17 15s. 10d. in 1912, £13 19s. 3d. in 1911, and £12 19s. 1d. in 1910. The main factor at work in the 12 months was, of course, the restriction of supplies from Mexico, coupled with the generally excellent statistical position, and the good demand from all sections of the consuming industries, notably the electrical trades. There was a persistent scarcity of lead for near and immediate delivery, which always commanded a considerable premium over forward metal. The very fact that there was a substantial premium, however, in this direction, militated against the growth of sufficient confidence to induce consumers to make purchases very far ahead, for they naturally feared a manipulated position, and bought with reserve. The situation in this respect has latterly been modified to a considerable extent, and the position at bottom appears to be quite sound. As has been suggested, however, much turns upon the outcome of affairs in Mexico.

Modernism in the Home.

It has been said that the most conservative institution in this country is the home. New methods are being tried in business with greater or less success, and new expedients are being applied to our social and economic life, but in many respects the means and methods adopted in the home are very much the same as were to be found in the Victorian era. Whether it is true that our better halves are more conservative in temperament, or whether the absence of the same degree of competition that prevails in business life renders the necessity for alteration in the home life less apparent, we are not prepared to say, but it is certain that in dealing with the sale of apparatus to be used in the home, this element of conservatism has to be reckoned with.

For this reason a salesman for electric cooking and heating appliances for domestic purposes meets with a certain amount of difficulty which is not experienced in other directions, inasmuch as he has not merely to convince the possible purchaser of the advantage of the new, as compared with the old, method and apparatus, but he has to do an immense amount of preliminary work in order to stimulate even that moderate amount of interest which is necessary to originate the preliminary consideration of any question. We referred a week or two ago to the excellent effect of popular lectures in awakening this preliminary interest, but it is feared that much of the other enterprise which has been associated with electrical salesmanship has been more or less misdirected. Electrical manufacturers and salesmen have gone on the assumption that it was only necessary to offer sufficiently convincing arguments as to the relative superiority of electric heating and cooking in order to secure sales, and to this end a good deal of care and attention has been displayed in the preparation of advertising matter and the proper equipment of showrooms. It is necessary to say that it is not intended in any way to depreciate the electrical showroom or the properly prepared advertising pamphlet, or, indeed, any means of advertising which appears to deal comprehensively and fairly with the sale to be effected. It should, however, be borne in mind that behind all this work the great and real difficulty, that of awakening the preliminary interest, is comparatively neglected. Before the argument as to electric heating and cooking in the home can be applied, an acute sense of the need for modernism in the home has to be created, and it is upon this point, we suggest, that the efforts of electrical salesmen should be more especially directed. It is no use having an electrical showroom if you cannot persuade the housewife to enter it. Pages of reading matter in the form of pamphlets, or in the daily Press, and even poster displays of the most attractive description will not induce a single sale if, in the first place, there is not sufficient interest created to make a prospective purchaser pay attention.

For this reason the treatment of electrical apparatus for use in the home should be regarded as an entirely separate market to that commonly associated with electrical enterprise. It must be approached from an entirely different point of view, and the campaign must be pressed forward by different means and methods.

Perhaps one of the best means of getting to work on a problem of this sort is to entrust the matter to a person of the feminine persuasion, inasmuch as ladies, in spite of much experience to the contrary, are still more inclined to trust one of their own sex than the opposite. For this reason it has been found by some electricity supply authorities that the lady canvasser is a most useful auxiliary to the electricity department. She can talk to the lady as "one honest injun to another honest injun," and can inspire more confidence in the subject under discussion than the most polished and persuasive male person. It is, of course, necessary for the lady canvasser to have some rudimentary knowledge of the application of electricity to heating and cooking, but inasmuch as a sale must not be approached from the point of view of technical electricity, but from that of modernism in the home, the technical aspect has to be kept well in the background, and hence a knowledge of the things which appeal to a lady in her home is far more important than a most thorough comprehension of physical laws applied to heating elements.

In spite of the conservatism of the British housewife, she has always sufficient appreciation of comfort and modern method to induce a purchase if the preliminary attention has been aroused, and it is upon the lines indicated above that such attention can be gained.

Electric Power on Warships.

In view of the greatly extended applications of electricity in ocean-going vessels of recent times, and the generally very satisfactory results which have been recorded in such cases, it is, at first sight, rather disquieting to learn from the *Pall Mall Gazette* that H.M.S. *Invincible* is to undergo a long refit, at a cost of nearly £200,000, principally in the matter of replacing electric by hydraulic power for operating the guns.

One must not forget, however, that the British Admiralty is an institution with historic prejudices, and although these have been very severely shaken in recent years by the evolution of such things as "Dreadnoughts," steam turbines, Diesel engines, wireless telegraphy, &c.—innovations which, in the interests of progress, absolutely could not be ignored—such prejudices die hard. We prefer to regard the *Invincible* refit merely as an incident, which in no way reflects on the adaptability of electric power for all purposes on a naval vessel, such adaptability having, in fact, been demonstrated already in certain vessels of the American, Continental and Japanese Navies, where traditional methods have less influence than in our own. We believe the *Invincible* is the only modern capital ship in the Navy fitted with electric power throughout, and while we regret the unfortunate outcome of the experiment in her case, we feel confident that the difficulties which have been met with will be successfully surmounted in later vessels. The matter is dealt with at some length by a correspondent in our "Notes" columns.

D

CARBON BRUSH HOLDERS.

By J. O. GIRDLESTONE, M.I.E.E.

It might be expected that the details of continuous-current dynamos and motors, after the experience of so many years, would be perfected, but it is surprising to find what a number of otherwise good machines are unsatisfactory by reason of faulty brush gear. It is constantly found that machines whose defects are sparking and rapid wearing out of commutators can be cured by changing the brush gear supplied with the machine for another type. With the type of holder shown in fig. 1, the defects are :—(1) In a multipolar machine the difference of potential between the point on the commutator under the spindle and the brush is very considerable, and flashing-over frequently occurs; (2) there is the risk that the spring may break or become detached and fall on the commu-

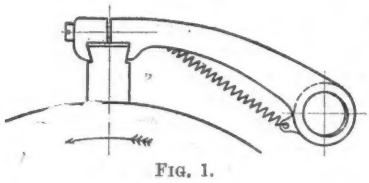


Fig. 1.

tator; (3) any slight unevenness of the commutator causes the brush to jump and to constantly break contact with accompanying sparking and wearing of the commutator. Cases have occurred in which large machines have been burnt out through the detaching of the spring above mentioned. With this type of holder also the distance between one brush and the next brush spindle is often quite small, with the consequent risk of short circuit and flashing over. Another serious defect is that with the slightest movement of the brush-holder the joint soon becomes loose, and it is no unusual thing to see holders of this sort with the hole $\frac{1}{8}$ in. oval.

The troubles above enumerated can be got over by using a brush-holder as shown in fig. 2. With this holder the

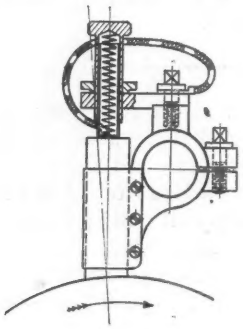


Fig. 2.

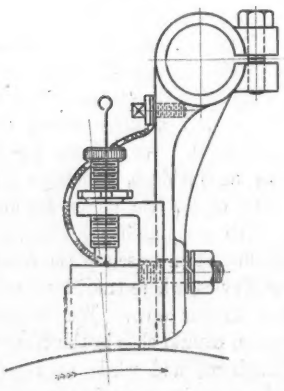


Fig. 3.

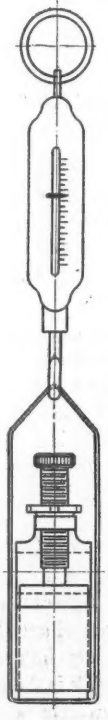


Fig. 4.

brush is kept in intimate contact with the commutator by the spring enclosed in the tubular screw; a light pressure is found sufficient to prevent any tendency to jump even when the commutator is slightly out of truth, a condition which is fatal to the first type mentioned.

In a reversible machine the brush should be set radially, but in a machine running in one direction only it is an advantage to set the brush at a slight angle against the direction of rotation. If the brush trails the other way the tendency is for it to rest on the heel, and sparking may occur under the front of the brush, as in fig. 5. It is found that when placed as first mentioned, it is not necessary for the brush to be a good fit in the box; it takes up its own position and banks firmly against the back of the holder. Of course, this is the well-known reaction principle, but the earlier brushes of this type failed, for one reason, because they were not fitted with copper flexibles to carry the current. Probably the most difficult machines for satisfactory commutation are turbine dynamos, and instances have occurred where new dynamos were practically unworkable owing to flashing over and bad sparking. After removing the original holders, and fitting a set of those shown in fig. 2, these troubles entirely disappeared. Holders for turbine dynamos require to be very strongly made, and fig. 3 shows a type specially designed for the purpose, and in successful use.

It is found that commutator wear is so small with this type of holder, that it is hardly necessary to provide adjustment for reduced diameter, but this can be arranged, if required, as shown in fig. 3, where the box carrying the brush slides on the fixed back in a groove, and is locked by a nut at the back; or the brush rocker may be made with a slot instead of a round hole where the brush spindle is bolted to it. It is advisable for the brush box to be as close as possible to the commutator, allowing the brush to project, say, $\frac{1}{8}$ in. only. It does not seem possible to give any fixed rule as to the best working

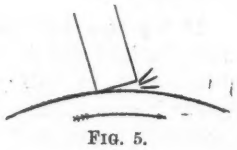


Fig. 5.

pressure. It depends on so many things, as, for instance, diameter of commutator, type of carbon brush used, current to be carried, and so on, but a very little experience with any particular machine will settle the point, it being understood that the lighter the pressure the better, provided that sparkless commutation is secured. With this holder it is easy to put on too much pressure, but when this is done it soon shows itself by the commutator getting unduly hot. Having decided the best pressure for any particular machine, it can be ensured for the future by weighing the pull of the spring; a stirrup is passed under the brush and an ordinary spring balance hooked on to it, as in fig. 4, and the adjustment is made to suit.

The brush-holders here described are made by the Westminster Engineering Co., Ltd., of Willesden Junction, N.W.

INSULATED ALUMINIUM CABLES: CURVES OF COMPARATIVE COST FOR ALL PRICES OF COPPER AND ALUMINIUM.

By J. B. SPARKS.

Quite a number of electrical undertakings, both in this country and on the Continent, are now employing insulated aluminium cables extensively in place of copper cables. A considerable saving in first cost is effected, and in view of the satisfactory operating results obtained, it is surprising that this application of aluminium does not increase at a more rapid rate.

Experience has proved that aluminium cables satisfy all the requirements of underground distribution, and possess certain advantages over copper cables in addition to that of lower first cost. Thus the smaller weight is of considerable

importance when transport facilities are poor; the larger section for a given conductance permits of slightly higher current densities without overheating; and even the greater diameter is an advantage in the case of extra-high-tension cables, in that it reduces the dielectric stress on the insulation.

But there can be no better argument in favour of aluminium cables than the fact that a number of responsible authorities, having satisfied themselves by experimental installations, have adopted aluminium cables as a commercial proposition. Amongst the users in this country are included the Corporations of Manchester, Bolton and Ealing, the County of London Electric Supply Co., the Metropolitan Electric Supply Co., and numerous mining and other private companies. The Continental users include the tramway undertakings of Paris, Zurich, Copenhagen, Nuremburg, Geneva, Lyons and Lausanne, the Chemins de fer de Neuilly, France, and the National Tramways and Light Railways Co., of Belgium. These are not small users. Zurich employs nearly 240 miles of aluminium cable, while several hundred tons of aluminium are in use for tramway feeders in Paris.

The saving to be effected by the substitution of aluminium for copper in insulated cables naturally varies with the relative market prices of the two metals, and, on account of the very heavy fluctuations in the price of copper, the difference in cost ranges from a negligible amount to very substantial percentages. This variation in the amount to be saved, and the consequent uncertainty in the minds of engineers as to the economy of a change, are largely responsible for the slow progress in the use of aluminium cables.

The object of the present article is to present groups of curves from which the actual difference in cost between copper and aluminium cables of any required type can be rapidly estimated for all prices of the two metals, and without the trouble of first calculating the equivalent section of aluminium. Fig. 1 shows such a group of curves for paper-insulated, lead-covered cables.

These curves are plotted from cable prices which have been estimated for cables constructed to the specification of the Engineering Standards Committee in respect of thickness of dielectric and lead covering, and are based on average prices for the cost of labour and materials other than the copper or aluminium core. The figures obtained were, of course, carefully checked by comparison with actual tenders and should represent fair average prices. The fluctuations in value of labour and sundry materials are not sufficient to affect seriously the usefulness of the curves, but it will be realised that, owing to these fluctuations, and the very variable percentage profit obtained in the cable business, the "net selling prices" read off from the curves are necessarily approximate.

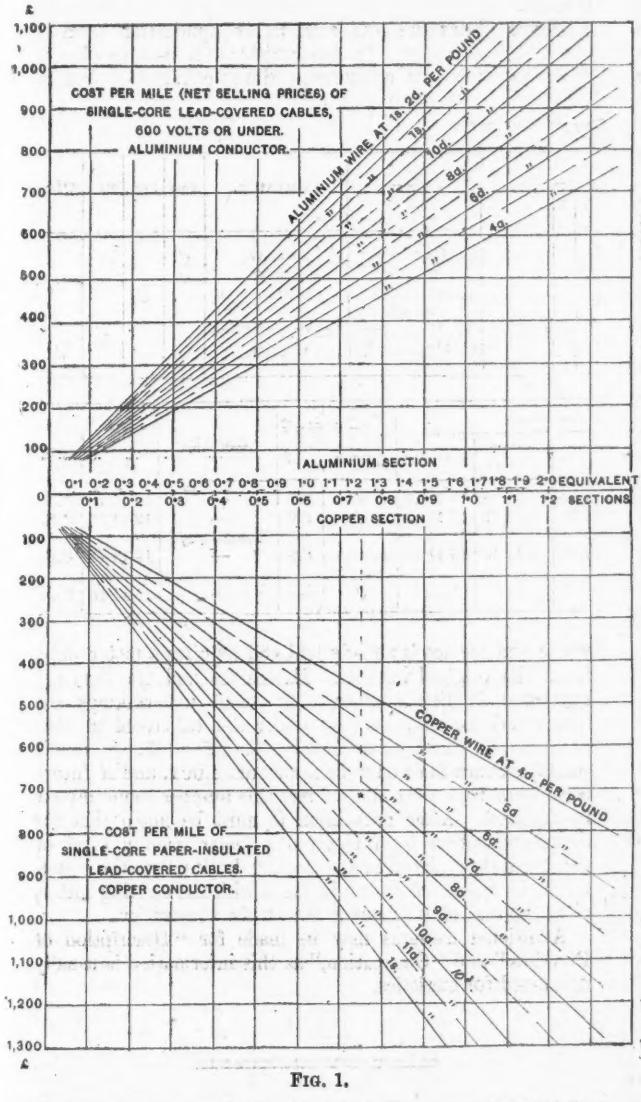

£
COST PER MILE (NET SELLING PRICES) OF SINGLE-CORE LEAD-COVERED CABLES, 600 VOLTS OR UNDER. ALUMINIUM CONDUCTOR.
ALUMINIUM WIRE AT 1s. 2d. PER POUND
ALUMINIUM SECTION
EQUIVALENT SECTIONS
COPPER SECTION
COPPER WIRE AT 4d. PER POUND
COST PER MILE OF SINGLE-CORE PAPER-INSULATED LEAD-COVERED CABLES. COPPER CONDUCTOR.

FIG. 1.

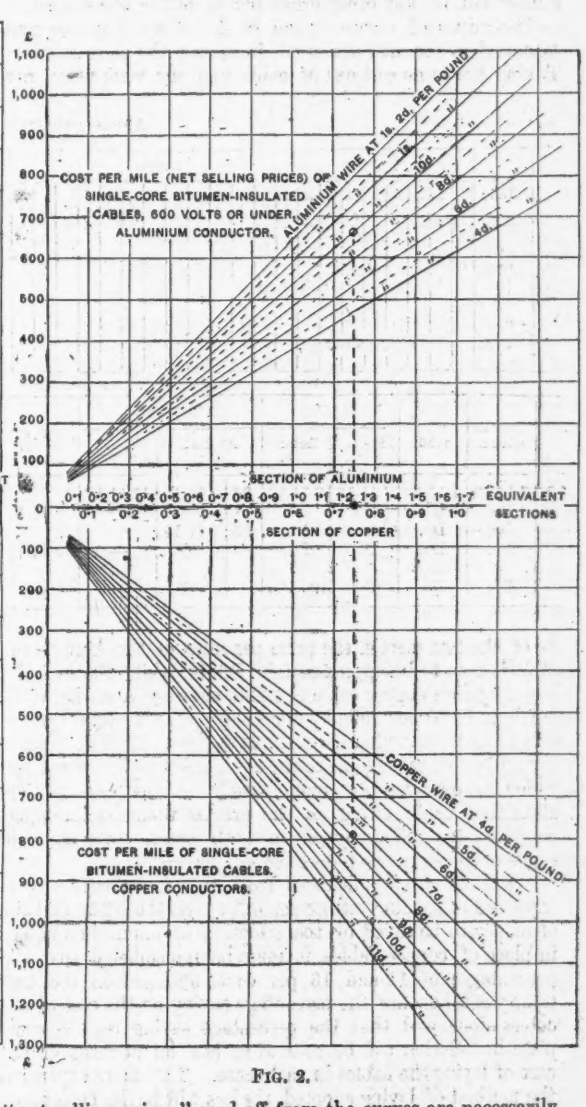

£
COST PER MILE (NET SELLING PRICES) OF SINGLE-CORE BITUMEN-INSULATED CABLES, 600 VOLTS OR UNDER. ALUMINIUM CONDUCTOR.
ALUMINIUM WIRE AT 1s. 2d. PER POUND
SECTION OF ALUMINIUM
EQUIVALENT SECTIONS
SECTION OF COPPER
COPPER WIRE AT 4d. PER POUND
COST PER MILE OF SINGLE-CORE BITUMEN-INSULATED CABLES. COPPER CONDUCTORS.

FIG. 2.

As, however, these particular factors affect the total cost of low-tension cables such as these only to a comparatively small degree, and as they will affect both types of cable almost equally, the difference in cost of the two types, and the percentage saving arrived at by a comparison of the figures, will be correct for all practical purposes.

As an example, let us assume that it is necessary to extend the cable system of a given tramway undertaking by the addition of 10 miles of feeders, single-core, paper-insulated, lead-covered, and all of a uniform section of 0·75 sq. in. copper, or the equivalent aluminium section. Let us assume further, that the market prices of the two metals are 10d. and 7½d. per lb. of annealed wire for aluminium and copper respectively. Along the horizontal scale of fig. 1 we find 0·75 sq. in. (noting incidentally that it corresponds with an

aluminium section of 1·25 sq. in.). Running up an ordinate from this point, we find that it meets the 10d. per lb. (aluminium) curve at £635, which is the price per mile of an aluminium cable of this section and for this price per lb. Projecting the ordinate downwards, we find that it meets the 7½d. per lb. (copper) curve at £715, which is the price per mile of the copper cable at the given figure for the price of copper. While these figures are approximate only, the difference in cost—namely, £80 per mile—will be practically correct, and thus we may be certain that at these prices per lb. of the two metals we shall effect a saving in first cost of £80 per mile, or £800 for the 10 miles required, if we adopt aluminium in place of copper. As a percentage, this is a saving of over 11 per cent. in the first cost of the cable alone. The effect of the additional expenses incidental to laying the cable, on the percentage saving, is dealt with further on. The reader can easily and rapidly estimate in the same manner the saving for any other section of conductor and for any other prices per lb. of the two metals.

The group of curves given in fig. 2 are for bitumen-insulated cables, and are used in exactly the same manner. Taking the same sections of cable and the same prices per lb. of the two metals, the price per mile of the aluminium cable is seen to be approximately £660, while that of the corresponding copper cable is £790, showing a saving of as much as £130 per mile by employing the aluminium cable, or a percentage saving of nearly 16·5 per cent. The greater saving in this case is due to the absence of the lead covering, which is considerably more costly in the case of an aluminium cable owing to the greater diameter for equal conductivity. The curves, in both cases, cover a wide range of prices per pound of the two metals.

While the saving deduced from the above curves, and expressed in pounds sterling per mile, gives the actual amount of money to be saved by the adoption of aluminium cables in place of copper cables, it must be remembered that the percentages of 11 and 16 per cent. obtained in the two examples taken are the percentage saving on the cost of the cables alone, and that the percentage saving on the complete installation will be somewhat less on account of the cost of laying the cables in each case. The more expensive the method of laying adopted, the less will be the percentage saving effected by the use of aluminium.

For example, let us assume that the lead-covered cable of the first example is to be drawn into earthenware conduit—a single duct embedded in concrete. This conduit will cost about £550 per mile, including materials, excavation and reinstatement. Drawing-in and joints will account for a further £40 per mile, and we may allow £70 for the cost of the necessary manholes. The total cost per mile of the completely laid cable will thus be (£715 + £550 + £40 + £70) £1,375 per mile for a copper cable, and as the aluminium cable costs £80 per mile less than the copper cable, £1,295 per mile for the aluminium cable. The percentage saving on the complete installation is, therefore, only 5·8 per cent. Nevertheless, this represents a sum of £800 on the 10-mile length of feeders as stated above.

If the cable is to be drawn into an existing duct, the percentage saving by the use of aluminium will be almost that estimated from the curves, while if a less expensive form of laying is adopted, the percentage saving will be something between that and the saving as reckoned in the previous paragraph. In all cases the actual saving in pounds sterling per mile is that read off directly from the curves.

APPLICATIONS-FOR-SUPPLY REGISTER.

BY A. C. GLOVER.

IN all cases an application form should be received and the usual inquiries instituted before any connection to mains is made.

Modus Operandi:—As soon as an application form is received it is entered in the register. A new number is given to every new consumer, and a re-connection, that is, where the service is already laid and requires a meter only, takes the original number. Extensions and transfers are numbered in like manner. In small undertakings the correspondence may be filed under the registered number given to the application form. Therefore W. Johnson's correspondence file would be numbered 1,001, and if future consumers took over his address this number would always be retained. After connection it must be noted that for every application form received a meter reading sheet or sheets must be placed in the reading book unless the installation is connected in conjunction with the existing meter, as in the case of Williams & Son in the illustration.

Additional columns may be made for "Description of Premises" and "Occupation," as this information is usually demanded for statistics.

APPLICATIONS-FOR-SUPPLY REGISTER.

Left side.

Reg. No.	Name.	Address.	Installation.	New	Rec.	Ext.	T'fer
1,001	Johnson, William	97, Queens Rd.	20-55 W.	√			
1,002	Turner, Philip	6, John St.	8-35 W.	√			
741	Harris & Co.	Albert Works, Fen St.	1-50 H.P.		√		
309	Williams & Son	19, Kingsway	125 W.; 20-35 W.			√	
412	Browne, James	24, Atherton Rd	13-35 W.				√

Right side.

Date received.	Date ackd.	Inquiry. Boro. treas.	Inquiry. Returned.	Deposit. Applied for.	Deposit. Paid.	Notifications. Mains dept.	Notifications. Returned.	Notifications. Meter dept.	Notifications. Returned.	Reading sheet placed in book.	Installation report.	Remarks.	Application filed. Date.	Application filed. By
7 11 13	7 11 13	7 11 13	9 11 13	£2	11 11 13	11 11 13	18 11 13	11 11 13	18 11 13	√	191	—	12 11 13	P.B.
Do.	Do.	Do.	Do.	—	—	9 11 13	14 11 13	9 11 13	15 11 13	√	190	—	12 11 13	P.B.
Do.	Do.	Do.	Do.	£3	9 11 13							Monthly a/c.		
Do.	Do.	Do.	Do.	—	—	9 11 13	14 11 13	9 11 13	15 11 13	Existing meter	192	—	12 11 13	P.B.
Do.	Do.	Do.	10 11 13	—	—	—	—	—	—	√	—	—	12 11 13	P.B.

Dublin.—ANNUAL REPORT.—The Electricity Supply Committee, in an annual report, states that it is considered advisable to recommend the Council to apply to the L.G.B. for sanction to a further loan for extensions. The continued labour troubles are held responsible for the delay in providing the additional 3,000-KW. generating set and boiler plant. Including this new plant, the city electrical engineer believes that the plant will be sufficient to cope with all demands up to 1916.

The principal items of expenditure in 1914-15, due to new connections, will amount approximately to £15,000. The increased demands in the old city area necessitate a considerable expenditure on supplemental cables and additions to the sub-stations. An expenditure estimated at £3,258 will be required to reconstruct the switchboards at the main power station, and the total expenditure in connection with the station is estimated at £14,950.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Insurance Companies and Consulting Engineers.

For some years certain insurance companies have been gradually extending what they are pleased to call their "engineering departments"—which means encroaching on work which has hitherto been considered the special sphere of the professional engineer.

If the companies employed properly qualified engineers to carry out the work, there would be less to say against the system, but it is well known that they do not offer sufficient monetary inducement to obtain good men. Further, properly qualified engineers will not take service alongside the clerks whom the insurance companies employ in their engineering departments.

Young men who have spent all their working lives at the desk are pitchforked into the surveyor's engineering department and sent out on inspecting work to value machinery, &c. Their principal qualifications are bluff and cheek, for they have no engineering or electrical knowledge. Occasionally, one of them feels so grossly ignorant of the duties, that he attends a class at a Polytechnic, with the idea of picking up a few scraps of information, to enable him to bluff a little more successfully.

It is such men as these who go to swell that great army of "engineering impostors" existing in this country. It has grown to an alarming extent owing to the engineering profession not having legal protection, as in the legal and medical professions.

The following are typical examples of the type of men whom the insurances companies dub "electrical inspectors":—

Individual No. 1 has the status of electrical resident inspector, and his duties comprise visiting owners of electric plant, advising them to have the same insured against breakdown, and fixing an inclusive premium which will cover loss through stoppages, and so on. He admitted to a teacher of electrical engineering that he had no electrical knowledge, and, when asked what the insurance covered, he could not say. Amongst other details, he was completely ignorant of what was meant by a "burnt-out armature coil," and had no knowledge of how such an accident could occur.

Individual No. 2 is in the surveyor's department of an insurance company, and his duties comprise the inspecting of electrical installations pointing out defects, and suggesting what must be done to remedy them. His electrical knowledge consists solely of a few hints gleaned from an elementary book on "Wiring." After a motor starter had been described to him, he said that he had always wondered what "those things with little round pieces of brass across them were."

"Earthing" was quite a mystery to him, and he asked if he was correct in stating to a client that "The ends of the pipe where the wire comes out should have bushes."

It is known in the electrical contracting business that hundreds of installations are passed by such men as these, when the installations do not comply with the rules which have been officially framed with the object of obtaining safety, and so raising the status of electric work in the public estimation.

But in addition to electric lighting, some insurance companies also pretend to give advice regarding complete installations of motors in factories and works.

Usually, when a manufacturing firm decide to go in for electric driving, it is because they have been led up to this decision by meeting engineers and reading articles written by engineers. Directly the insurance company hear of it, they say to the secretary of the company: "We will advise you as to size and type of machinery, motors and switchgear, &c., to use, will specify and see the work carried out, &c., and will insure the whole installation at a lower premium than we will accept if it is carried out by a professional engineer."

Now, without any beating about the bush, the indictment of insurance companies includes the following:—

They employ men who have little or no knowledge of the theory and practice of engineering. They advertise in the most brazen manner, and they deliberately cast reflections on professional engineers. Generally they do all those things which ordinary manners, to say nothing of etiquette, forbid the professional engineer.

Being a corporation, the councils of the Engineering Institutions cannot get at them, and, truth to tell, the Institutions, which should have acted in defence of the profession of engineering, have been content to allow the members to look after themselves. Some of these Institutions employ men as secretaries who are not engineers, and who are, therefore, not able to see things as they appear to engineers.

The question is—How long is this scandal going to continue, and what can qualified engineers do to show it up, and perhaps stop it? One thing that occurs to the writer is that engineers as a body might deliberately boycott those insurance companies that run these bogus engineering departments. Most men are insured nowadays, and also insure their houses, furniture, &c. Why not have a black list of those insurance companies which are deliberately acting contrary to the interests of engineers?

Tyke.

December 31st, 1913.

Protection or Tyranny?

I have, up to the present, refrained from openly criticising the actions of the B.E.A.M.A. whilst the question of "general conditions of tender" was still the subject of negotiation between the various interests concerned, although very little negotiation can be possible, in view of the attitude adopted by the dignitaries at their palatial offices in Kingsway. Their latest action, however, is one which shows the Association up in an even worse degree than could be possibly imagined.

My Council recently invited tenders for new plant; specifications were in the hands of the manufacturers by December 15th, and the tenders were to be delivered by December 31st. The B.E.A.M.A. sought for an extension of seven days on account of Christmas holidays (two days) intervening, but this not being acceded to, the Association took it into their own hands, and their members were not permitted to send in their tenders by the date specified. I have it on authority that a number of firms were prepared and desired to send in their tenders as requested, but the B.E.A.M.A. resolved not to allow this to be done, and that my Council must wait until January 7th.

A more vicious form of protection one could not imagine, and it far surpasses anything that our professional politicians could achieve at Westminster.

The humorous side of the matter has been the many varied excuses each firm has offered for not returning its tender, but none of them had the courage to state the proper reason, viz., their helpless individuality as members of the B.E.A.M.A.

When we consider that the Association, through its members, is forcing upon the purchasers "general conditions of tender," which individual members of the Association would not accept in connection with contracts in which they were the purchasers, and now ruling as to when tenders are to be returned, we shall soon be told what plant we can or cannot have; perhaps we shall be ordered as to how much load we shall connect up and the price we are to charge for the same.

What with the Cable-Makers' Association, the Tungsten Lamp Conference, the minimum prices for meters and motors, and last, but not least, the B.E.A.M.A., it seems as if the electrical industry has the worst monopolies of any, and is doing more to hinder the advancement of electricity in this country than political parties can ever do; in fact, we shall have to look to the latter to free us from the fetters of combination which eliminate competition and increase dividends at the expense of progress.

F. W. Purse,
City Electrical Engineer.

Carlisle, *January 5th*, 1914.

Concerning a Review.

My attention has been called to Mr. Rankin's letter in the current issue of your valuable paper, and as the author of the book referred to, I will be pleased to have, either through the Press or privately, any criticisms Mr. Rankin may have to make on the subject matter incorporated. I am rather of the opinion that there are no incorrect diagrams or technical details, but there may be "sins of omission" due to the limited space available in so small a book, and I should so judge such criticisms as Mr. Rankin puts forward, on which there appear to be no details, more under the class that explanatory notes are omitted for the above reason. I think this is explained in the preface, and the complement matter of such a broad subject has, of course, had to be considerably curtailed.

A. G. Collis.

Brentwood, *January 2nd*, 1914.

After reading Mr. Rankin's letter in the current number of the ELECTRICAL REVIEW, I am not at all surprised at his first one. He states that it is poor justification for one reviewer to point out that a book has been favourably reviewed by another man in another periodical. I think precisely the reverse. After carefully considering everything Mr. Rankin has said to the contrary, I am still of the opinion that Mr. Collis's book is well worth the price asked, and I have pleasure in recommending it.

The Reviewer.

January 6th, 1914.

Jumping Arc Lamps.

Suppose a line of arc lamps is jumping and flickering in consequence of one lamp being out of order, what is the best and quickest way to find out which one is the offender?

Lowering them in succession and cutting out one by one, with an interposed resistance or otherwise, is a terribly long and tedious business, as the fault may not be always on, and to make the test accurate might need many nights of work, yet this is the only remedy I have been advised of so far by friends, or even by a noted engineering paper in which I asked for information. Surely there must be some better and quicker way. What do the electricians in charge of street, dock and big railway station arc lamps do?

E. P. C. C.

Not an Electric Fire.

The obscure origin of the fire which recently destroyed a large portion of the famous castle at Schwerin has led to the propagation of the usual rumours regarding short-circuits. The official investigation has completely disproved them, and it has, moreover, been established that the salvage work was enormously assisted by the electric lighting installation. On the discovery of the outbreak all lamps were lit, and they were left to extinguish themselves as the branch fuses melted. In many cases the lamps burned long after the fittings were cracked and broken and until the ceilings fell.

It is stated that without the help of the lighting it would have been impossible to save many of the portions which have been preserved.

J. S. Messent.

Berlin, *January 4th*, 1914.

The Ignorance of Home Office Requirements.

Mr. Frank Broadbent's lecture to electrical manufacturers and contractors may be well deserved, but it is certainly not far-reaching enough.

If electrical apparatus of any description is unsafe in the workshop, why not so in the mansion?—or, in other words, why is the faulty material authorised by other recognised regulations? Bearing in mind the extra cost that Home Office pattern material usually involves, this anomaly operates very harshly against the well-informed contractor when in competition.

L. E. Wilson.

Manchester, *January 3rd*, 1914.

Association of Mining Electrical Engineers.

Chatting with a friend during the holidays, he informed me that he had ignored this Association for three years, but that he regularly receives notices of meetings, and an intimation now and then that his subscription for the current year is unpaid.

It would be interesting to know how many of the 1,100 members which the Association is said to have, have paid the subscriptions for the current year, last year and the year before. If my information is correct, in April, 1912, only about 65 per cent. of the names on the register had paid the subscription due in July, 1911.

Mr. J. Glynn Williams's analogy of the little boys who hide round corners when snowballing is capable of a little further amplification—there is always one little boy who comes out and says: "Please, Sir, it wasn't me, Sir."

Outis.

London.

Sulphate of Ammonia Manufacture.

We have noticed in your issue of the 19th ult., an article by Mr. Georges Dary on "The Production of Nitrates by the Direct Electrolysis of Peat Deposits."

In the course of the article the writer refers to the "Buckle process," which is the property of the International Nitrogen and Power Co., Ltd.

We shall be glad if you will allow us to correct the very inaccurate statement as to the cost of the "Buckle process," made by Mr. Georges Dary.

Without going into any details of the process, which is not solely concerned with the manufacture of sulphate of ammonia, we may say that, with the aid of the above process, and with suitable peat bogs, sulphate of ammonia can be made at less than one-half the price stated by Mr. Dary. The process, also, is self-supporting, inasmuch as it does not depend on any extraneous supply of power, such as the provision of a large amount of water power, which is necessary in the process which is described by Mr. Dary.

Trusting that you will bring this statement to the notice of your contributor.

The International Nitrogen and Power Co., Ltd.
SAML. C. FORMLEU, *Secretary*

London, S.W., *January 5th*, 1914.

The Position of Railway Electrical Staffs.

In reading through "Nemo's" letter I think he has done well to bring to the Metropolitan Railway Company's notice the fact of the electrical staff's loyalty during the last railway strike.

The electrical staff must be considered a big factor in the running of railways of the future in view of the electrification of the different lines that is in progress.

During the past year the Metropolitan Railway have increased the plant at several sub-stations, including plant for automatic signalling, which all means more responsibility on the engineer in charge of each station.

Therefore, I think the company might with advantage do something to raise the standing of the electrical staff and promote a feeling of contentment among the staff which would ensure greater efficiency. Dissatisfaction gives low efficiency in great or small concerns.

Dum Vivimus Vivamus.

With reference to your correspondent "Nemo's" letter under the above heading, I should like to add that the electrical staff of the Great Western Railway are in an exactly similar position to that of the staff of the Metropolitan. We also have sent in petitions, and similarly, we get no replies.

I fail to see, however, that any material advantage would accrue if the electrical staff were placed on the permanent staff, for, as a body, we should still be without representation. As we are classed with the uniform staff, it is obvious that the only way to secure recognition of our grievances is to join their society. By this means only shall we ever be able to speak with a voice that will make itself heard.

Synchroscope.

Jerry Wiring.

I should like to draw your attention and that of the exercising authorities and the electrical trade generally to the nature of the electrical wiring for carcass work and the way in which it is being installed in the suburbs of London; in a house in its carcass state, fitted with between 9 and 14 lights, in some cases the casing is used without capping, reversed to the joist, leaving the wires at places absolutely uncovered; the wires that drop to the switches are encased in slip-joint tubing, buried behind plaster, leaving generally a gap between the end of the tube and that of the casing, the wires not being encased; other places being a little awkward, the wires are run behind the laths without casing or tubing. Now, I think the time has come when this sort of work should be condemned and those that are responsible for it, as it is not only dangerous but detrimental to the electrical trade generally. This kind of competition should be stopped, as it is both ruinous to the ignorant, and unfair to the contractor who is trying to get a fair living as the result of doing good work for bad prices.

Observer.

American Methods.

I have been much interested in the articles on "American Methods" in your issues of November 14th and 28th.

When I finished reading Mr. Seabrook's article, I felt that he had written on a subject that has often tempted me. I congratulate him on it and the ELECTRICAL REVIEW on publishing the same.

After a perusal of the article by "F. W. D." I feel compelled to write and say that your contributor is either prejudiced against Americans and their methods, or ignorant, or else has happened across an isolated instance where he has gained a false impression. He does not write the truth. Maybe your contributor has only met Americans of the tourist variety, on the other side—one can hardly credit his ever being employed over here.

Some Americans are self-assertive. That is not a bad fault for some Englishmen to have, it seems to me. I will not deny they are sometimes boastful over here, but they certainly do have some things to boast of in the electrical industry compared with those at home. I have never experienced any overbearing manner among those of the American electrical fraternity.

If any man has ambition, he naturally hopes to attain a position of authority, or as your contributor prefers it, "to be a boss."

As regards co-operation, what about the members of the N.E.L.A.? I know for a positive fact there is certainly no lack of co-operation between the electrical interests on this side. I, myself, am called upon, almost every day, to co-operate with others, and not exactly for the sake of the mere dollar or two there may be in it. Do not the slogans of the Society for Electrical Development and of the Sons of Jove offer evidence of the spirit of co-operation?

I have not been able to discover in almost seven years' residence in the United States any evidence that "a workman cannot be relied upon to work his hardest except under pressure" in so far as this does not apply to England as well. When your contributor refers to workman (presumably mechanic and labourer) it must not be overlooked that the majority of the rough work and the less skilled machinists' work is done in America, not by Americans, but by the immigrant from Southern and Eastern Europe. To get satisfactory work out of Greeks, Slavs, Poles, Hungarians, Bohemians, and the like, especially when all the races are represented in one shop, needs different treatment to what those at home might deem desirable or necessary.

Most American enterprises do pay a dividend, in spite of attractive prospectuses that might be issued from time to time. I believe I have read in the ELECTRICAL REVIEW comments on the small returns British companies make in comparison with those in America.

Monopoly is not such a bad thing as it may seem to many. At any rate the day of the isolated small manufacturer is almost done. The requirements to-day are on so large a scale, and the development costs so high, that only large and sound concerns can successfully undertake the work.

The immense field now covered by the electrical industry demands specialisation. Specialisation does not eliminate all personal interest; it stimulates it. It is obvious that any man who is not interested heart and soul in his work is a failure at the start. Without a specialised system in a large plant there would be chaos.

I really believe your contributor, when writing on welfare work, deliberately misinterpreted Mr. Seabrook's remarks. It is surely advantageous to the work-people that sanitary conditions should prevail in the works; that their mid-day meal, which is often provided in restaurants in the factories here, is wholesome, well cooked, and as low in price as possible. The location of a factory in a good, open, healthy place; adequate lighting, both by day and night; warmth in the winter, and so on, are all a part of "welfare work," which your contributor apparently so purposely overlooks that your readers might almost judge him a man of very narrow experience.

Regarding salesmanship, I believe this to be the most important problem that a merchant has to handle. Order taking is not to be confounded with salesmanship. The latter is certainly recognised in this country as a worthy and desirable branch of the profession to follow, and the electrical engineer salesman is generally a well-paid employé.

A man from Mexico recently told me that there were only two countries that had electrical manufacturing concerns worthy of note, namely, the United States and Germany. He stated that the British electrical manufacturer was very poorly represented, both by men and machinery, in Mexico.

I know that Britain can be represented, if her manufacturers will wake up. It may be true, to some extent, that American methods do not suit the industrial conditions at home, and that the temperament of the people there is somewhat adverse to change, but if Britain expects to progress with the rest of the world, she must use methods that can successfully combat those of her competitors, not go to sleep.

English.

Newark, N.J., *December 19th*, 1913.

St. Marylebone New Turbine Plant.

In your issue of December 5th last appeared a somewhat glowing description of the two high-speed turbo-alternators which have recently been supplied to St. Marylebone by Messrs. Oerlikon. Interesting though the article was, it would be still more instructive if you could obtain for the power plant users some definite and authoritative information as to the actual performance of the machines in question.

All sorts of reports have been passed round; indeed, it is common talk that at the very moment we shift dogs were reading the article over our evening cup of tea, the much-vaunted foreign machine burst one of her L.P. wheels, and is now a total wreck. The same small bird keeps on whispering about similar, but less serious, trouble with the second set. Can you obtain some definite information to appease the thirst for knowledge of

Three Shift Dogs.

January 5th, 1914.

[We have made inquiries and find that the reports referred to are very greatly exaggerated. About a month ago the 10th rotor wheel in No. 1 Oerlikon turbine fouled the stator disk, and the damage which ensued necessitated the return of some of the parts to the makers for repairs. Mr. Seabrook expects that the turbine will be running again about the end of this month. The cause of the mishap is somewhat obscure, but it is thought that the lubricating oil used for the thrust bearings was not of the right consistency, a thinner oil being preferred by the makers. There was nothing in the nature of an explosion.

As regards No. 2 turbine, a slight contact took place between the rotor and stator, but on examination it was found to be of a trivial nature; the turbine was set to work again and has since been running day and night quite satisfactorily. Mr. Seabrook points out that similar incidents occur almost invariably on starting up a new set, of whatever make.—EDS. ELEC. REV.]

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Crystal Fittings.

THE GENERAL ELECTRIC CO., LTD., have just issued a catalogue of 40 pages in which they give excellently-executed illustrations of a full range of electric light fittings constructed wholly or partially of crystal glass, a type of fixture which is stated to be becoming increasingly popular amongst those interested in general decorative and illuminating schemes for dancing-rooms, halls, restaurants, theatres and like places. In many cases crystal glass pendants or lustres are found to be the only electric light fittings which will harmonise with and fully accentuate the beauty of the architecture. This new list is entitled "Electric Fixtures in Crystal Glass," and should be useful to electrical contractors.

With most of the pendants and electroliers spare crystal drops are included to replace possible damage. We understand from the General Electric Co., Ltd., that no general distribution is to be made of this catalogue, but they will be pleased to forward a copy to those interested on application to the head office, at 67, Queen Victoria Street, E.C., or to any of the provincial branches. A couple of the designs are shown in the accompanying illustrations.

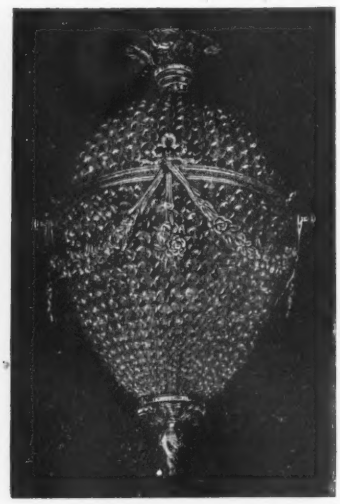


FIG. 1.—G.E.C. CRYSTAL PENDANT.

FIG. 2.—G.E.C. CRYSTAL FITTING.

Portable Electric Grinder.

MESSRS. H. W. BUTLER & CO., of Craven House, Kingsway, W.C., have recently introduced a handy little electric grinder—the H.B.—which can be fixed to a tool-holder on the lathe, milling or shaping machine, and is useful for grinding dies, reamers, cutters, &c. The device weighs 5½ lb., and consists of a $\frac{1}{12}$-H.P. motor (operating on either direct or alternating current) running at 10,000 R.P.M. Dust-proof bearing caps are fitted; the motor is air-cooled and accurately made, and will operate from an electric lamp socket, through a flexible cord and plug which is supplied with the apparatus.

Recording Instruments.

Some new patterns of recording instruments have been introduced by MESSRS. SIEMENS BROS. & CO., LTD., of Woolwich. One of these is shown in fig. 3, a small and inexpensive instrument with a simple movement, and chart 70 mm. in useful width. The movement is provided with a vertical spindle, and the paper passes through guides which cause it to assume a curve surface corresponding with the circular arc described by the recording point, becoming flat again some 6 in. from the pointer; thus the chart is ruled with straight lines, and can be divided according to the same law as the natural scale of the instrument. The vertical spindle works with less friction than a horizontal one. The instrument is made for both A.C. and D.C.

Another type of instrument is provided with a straight-line motion consisting of an ingenious link mechanism which guides the pen, and the control spring can be so arranged that the deflections on the chart are proportional to the quantity being measured, so that the scale is uniform and the records can be integrated. The link motion above mentioned is used in the recorder illustrated in fig. 4, a D.C. moving-coil instrument which can be made as an ammeter, voltmeter or wattmeter. The movement is well damped, and the insulation is tested with 2,000 volts alternating, all metallic parts that can be touched being earthed to prevent shock to the user. Recorders of the induction and spark types, and instruments for recording frequency, time, &c., are made.

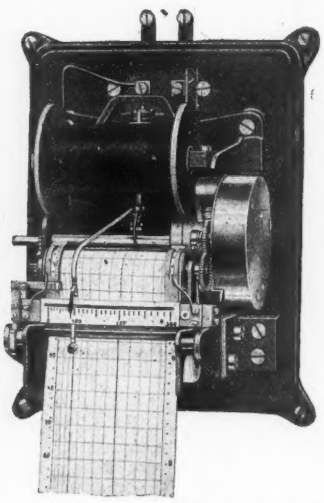


FIG. 3.—SIEMENS SMALL RECORDER, COVER REMOVED.

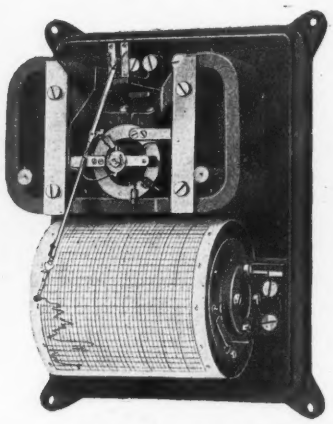


FIG. 4.—RECORDER WITH DRUM CHART, COVER REMOVED.

The "Robj" Lighter.

MESSRS. BEST & LLOYD, LTD., of Cambray Works, Handsworth, Birmingham, are placing on the market the "Robj" cigar lighter, consisting of a special type of resistance and porcelain insulator with spring contacts, fitted with a torch containing cotton wool saturated with benzine. The torch is ignited by simply withdrawing it, and does not ignite when replaced. The wick is of indestructible material, and the torch is perfectly insulated. The ordinary resistance is suitable for use on 200 to 240-volt circuits.

Fig. 5 shows a combined lamp and lighter made by the firm.

FIG. 5.—COMBINED LAMP AND CIGAR LIGHTER.

The Railophone.—We learn from MESSRS. INTERNATIONAL RAILOPHONES, LTD., that they have just received a third trial order from the Swiss Federated Railways for "K.K." detectors. This instrument has been used to transmit telegraphic messages through the St. Gothard tunnel.

PHYSICAL SOCIETY EXHIBITION.

(*Continued from page* 14.)

Isenthal & Co.

Sliding rheostats in a number of patterns, and the new "Condenser" influence machine, were the principal features of this firm's exhibit, but perhaps a still more attractive item on the stand was a collection of Pladuram products—ore, and compressed sticks, bars, wires from 0·5 mm. to 0·015 mm. in diameter, contact disks and spiral springs, all made of pure tungsten—shown for the first time, we believe, in this country.

The condenser electrostatic machine, fig. 11, is that devised by Dr. Wommelsdorf, and so called on account of the arrangement of interleaved fixed and rotating disks which, being influenced on both sides, generate twice as much current as in the ordinary type of influence machine. Thanks to this and other new features, the machine is able to give out a current 20 to 50 times as great as an ordinary machine of equal size, and the machine also excites itself with facility, even in damp weather. The current is collected at the periphery of the rotating disks by a device which eliminates the capacity effects and leakage of the older collectors, and a spark can be obtained of a length equal to two-thirds the diameter of the rotating disk; the collector is made of steel wires running in a groove in the periphery. The metal sectors are vulcanised into the mass of the rotating disks, and similarly the exciting plates are vulcanised into the insulating supports. The superiority of ebonite disks over glass is diminished by the deteriorating effect of ozone and daylight upon their insulating properties, but this drawback is completely eliminated by coating the disks with a film of Bakelite, which permanently protects the ebonite and has very excellent insulating properties of its own. The Leyden jars are similarly covered with Bakelite, and various mechanical improvements in design have been made.

While half the output of an induction coil has to be suppressed when generating Röntgen rays, the condenser machine generates unidirectional current only, the whole of which is useful; this is advantageous also in other applications of the machine, and simplifies the apparatus required. While an ordinary influence machine, with two rotating disks, 26 cm. in diameter, gives a maximum spark length of 100 mm., and a current of 15 micro-amperes through 1,000 ohms, the condenser machine with one rotating disk of this size gives a spark length of 175 mm., and a current of 130 micro-amperes: an ordinary machine, with 12 rotating disks 55 cm. in diameter, gives a spark of 220 mm., and a current of 140 μa, while the condenser machine, with one rotating disk of 55½ cm., gives a spark of 330 mm., and a current of 600 μa. The superiority of the new machine, therefore, is clearly manifest. A more detailed description appeared in our issue of August 29th, 1913.

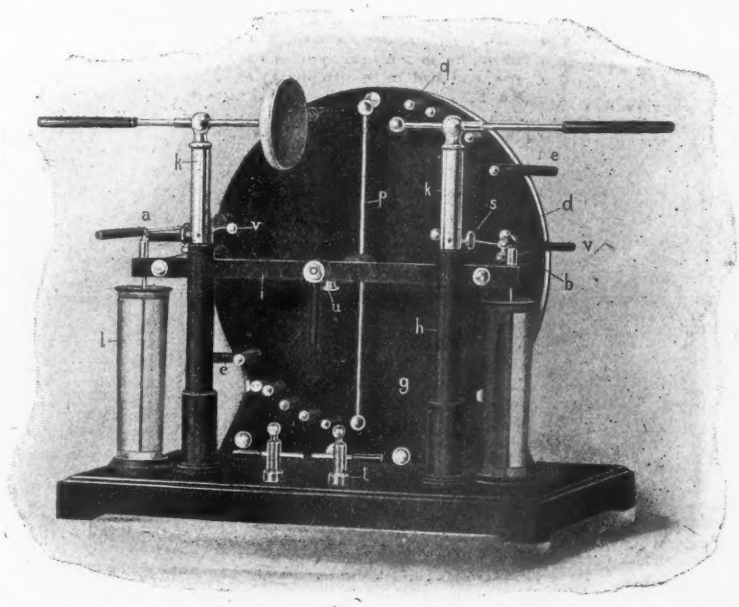


Fig. 11.—Wommelsdorf Condenser Machine.

Gambrell Bros., Ltd.

Amongst a variety of electrical measuring apparatus, a new plug and galvanometer shown by this firm were of special interest. The former is described as the independent plug contact (T. E. Gambrell's patent), and is illustrated in figs. 12 and 13. In this device all parts are interchangeable, and exceptionally large surface contact is provided with all types of resistance-boxes and switches. This, it is claimed, is a great advantage, as all plug apparatus in the testing-room can now be made to one standard cone. This was impossible with the old type, as, to give anything like large surface contact, heavy brass blocks were necessary. With these plugs there is, of course, no fear of slackening the adjoining contacts when one plug is withdrawn.

The following are a few of the advantages claimed for this

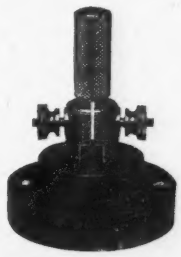


Fig. 12.—Independent Plug Contact.

device:—The plugs are independent of each other; each unit is self-assembling; there is larger surface of contact; there are no plug-

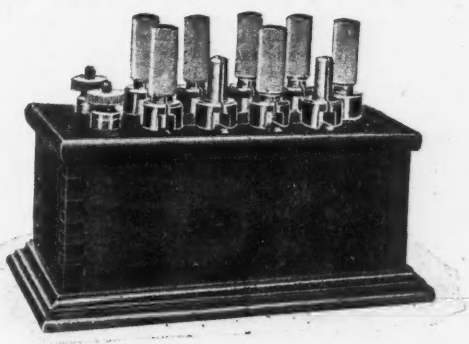


Fig. 13.—Resistance Box with Gambrell Plugs.

heads to go wrong; high insulation is obtained, and the parts are easily cleaned.

The new moving-coil galvanometer is the invention of Mr André Onwood; its construction is shown in fig. 14. The circular coil *a* has a small tube *b*, fixed radially to it, down which passes the suspension *c*, from point *h*, at the centre of the iron core *j*, to the cross pin *g* fixed in tube *b*. The coil and tube are kept in a vertical position by means of the weight *e*, on the lower end of rod *f*, the top end of which is rigidly fixed in the base of tube *b*.

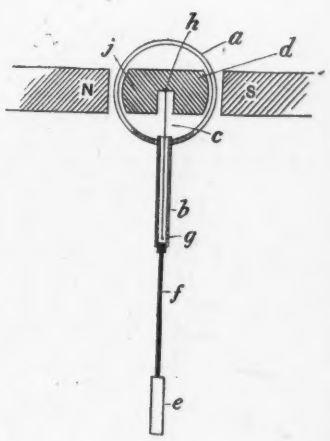


Fig. 14.—Suspension of Onwood Galvanometer.

The coil thus being suspended from its centre, the point *h*, it will always oscillate about that point, and never come into contact with the magnet poles or core, however much the instrument is out of level. This frees the instrument entirely from levelling and attendant troubles, and allows of the use of a very narrow gap which increases the field strength enormously, and therefore the sensitivity in practically the same proportion (pointer instruments give a full-scale deflection of 70° for 1 micro-ampere, reflecting galvanometers 2,500 mm. per micro-ampere at 1 metre). The

narrow gap also increases the stability of the magnetic field, thus rendering the instrument less liable to alterations in calibration due to variations in field, and less affected by external fields, while the uniform distribution of the field gives an evenly-divided scale.

In ordinary suspended galvanometers the gap is large, causing bad and uneven distribution of field. This makes the constant and zero vary considerably, even with very small variations in tilt from the position of previous calibration, as it is impossible, with the ordinary methods of levelling, to bring the coil to the same position in the field; the constant must be taken, and the zero adjusted, very time the instrument is moved. In pivoted galvanometers the readings are liable to vary with the tilt, as it is impossible to balance the moving system perfectly.

It is almost impossible to break the suspension, a small spring being placed between the top of the suspension and the iron core at point *h*. In the event of the instrument receiving a blow, the coil drops slightly, and the coil former rests on the iron core before the stress on the spring is enough to break the suspension. This makes the instrument very robust, much more so than any pivoted galvanometer, whose delicate hard pivots, turning in very hard jewel bearings, are easily damaged by shock.

The movement of this galvanometer will always swing about a vertical axis, whatever the tilt of instrument, therefore the pointer will always move horizontally over a scale which lies at an angle to the horizontal by the amount of slope of the instrument, and it might appear that the scale readings would increase from this cause, as the deflection of the pointer divided by the cosine of the angle of tilt, but the magnet and core will also be sloping at the same angle as the scale, thus rotating the field round the coil and reducing the torque as the cosine of angle of tilt; obviously, therefore, the scale readings will be constant at any level for the same current.

The constant of the reflecting galvanometers will vary as the cosine of angle of tilt, but this decrease is very small; these instruments are used on surfaces varying very slightly from the level, and for a surface 2 or 3 degrees from level, the error will only be 5 in 10,000. An ordinary galvanometer could not be worked at all at this tilt; a table 2 or more degrees out of level would be a monstrosity. For precision work a square or other parallel-sided coil can be fitted, the gap being slightly larger; then the constant will not vary at all, however much the instrument is out of level.

These instruments are robust, very sensitive, high speed, the coil being very light, and the balance weight being so narrow that it possesses very little inertia, therefore a high figure of merit results.

Muirhead & Co., Ltd.

The Heurtley patent magnifier for use in telegraphy, and Col. Squier's "wired-wireless" patent field apparatus were the chief novelties of this exhibit. The former is employed to magnify the effect of very small mechanical movements in cable or wireless telegraphy.

The principle of the instrument is as follows:—Two very fine wires with high electrical temperature coefficient are mechanically connected to a recorder coil which is acted upon by the incoming current. These wires form two arms of a Wheatstone bridge circuit, the other two arms being fixed resistances. In place of the galvanometer in this Wheatstone bridge circuit is placed a recording instrument, such as the ordinary siphon recorder. The Wheatstone bridge is supplied with current from a local battery, of sufficient intensity to heat the fine wires considerably above the temperature of the surrounding atmosphere. These wires are so positioned that when no signals are being received they lie theoretically half in and half out of blasts of air which blow continuously in a plane at right angles to the plane of movement of the wires. On the latter being moved in one direction or the other by the incoming current, one is inserted more into its blast of air and the other is inserted less. Thus, one wire, as a whole, becomes more cooled, and the other wire is less cooled by the air-blast, so that the total resistance of the cooled wire is reduced and that of the other increased.

As the two wires are arranged on the adjacent sides of the Wheatstone bridge local circuit, these changes in the balance are additive, with the result that a current passes through the siphon recorder coil, which reproduces the movement of the primary coil in magnified form, the degree of magnification depending upon the strength of the blast and the intensity of the current passing through the wires. Suitable means of adjustment are provided. The magnifier produces an increase of speed on duplex cable working of from 40 to 50 per cent., and has been adopted by many of the cable companies.

The "wired-wireless" system allows both telegraphy and telephony to be accomplished simultaneously over the same wires, and is intended for military purposes. The ordinary methods are adopted for telephoning, but telegraphing is effected by means of a current having a frequency of about half-a-million cycles per second, impressed upon the wire by an oscillatory circuit inductively coupled to the line. As the "radiation" is guided by the wire to its destination, very little power is required. At the receiving end the line is inductively coupled to a tuned circuit, and a detector of carborundum and steel is employed. The apparatus is very compact and easy to operate, and enables a great economy of wire, &c., to be effected, by using one wire for the double purpose. No antenna is required, and an iron spike driven into the ground affords an adequate earth. There is not the slightest interference between the two methods of communication.

(To be continued.)

LEGAL.

Watkins *v.* Harrod's Stores, Ltd.

On Thursday last week, at the Brompton County Court, before his Honour Sir W. Lucius Selfe and a jury, Mr. F. A. Watkins, of Stroud Green, N., an electrical engineer, sued Harrod's Stores, Ltd., for £157 6s., which he claimed as compensation in respect of an injury which he had received on the defendants' premises. Dr. Kingsbury appeared for the plaintiff, and Mr. Patrick Hastings represented the defandants.

In opening the case, Counsel said that it was brought under the Employers' Liability Act by the plaintiff, who was an electrical engineer of considerable experience in his profession. For nine years he had been in the employ of the Hornsey Corporation as their senior engineer in charge of the power station. Prior to that he had been employed by the Ipswich Corporation. Last May plaintiff answered an advertisement which was inserted in one of the electrical papers, and as the result of an interview was engaged as assistant to the chief engineer, Mr. Howes, at Messrs. Harrods. At first plaintiff asked for £3 10s. a week, but as he had his meals on the premises he accepted a salary of £3 cash. In the afternoon of August 26th, Mr. Howes had to go out, and he asked the plaintiff to keep special watch on the deep-well pump. One of the most essential duties the plaintiff had to perform in connection with that pump was testing, from time to time, the temperature of the cranks, which, as in other pumps, had a tendency at times to get over-heated. In order to test the temperature, it was necessary for the plaintiff to mount from the floor on to a wall which surrounded the bed in which the pump was working. The wall was only abont 7 in. wide, and the crank came within an inch of the wall. While the plaintiff was carrying out his instructions in testing the crank it came down upon the toes of his right foot and crushed them. The result of the injury was that plaintiff was incapacitated from work for some considerable time. The accident happened in mid-week, and the defendants at the end of the week sent Mr. Watkins a cheque for 30s., saying that that was what he was entitled to according to the time book. Plaintiff thereupon wrote for an explanation. For several weeks afterwards he received a postal order week by week for £1 from Messrs. Harrod's, who said that it was compensation under the Workmen's Compensation Act. As the plaintiff did not come under that category, he returned those payments, and brought the present action. His (counsel's) contention was that the pump, working in the position it occupied, should have been fenced, and if it had been so protected there would have been no danger whatever to the plaintiff in carrying out his instructions. The plaintiff had obtained another position, but only at £2 10s. a week. There was great competition in the electrical profession, and people had to take what post they could get and work themselves up. Therefore his position was very much worse, and, in addition, he lost his salary of £3 10s. during his illness, and, of course, had had to bear the heavy expenses of that illness.

Mr. F. A. Watkins, the plaintiff, bore out counsel's opening statement. He had to stand on the bed-plate, which was 2 ft. 6½ in. high, and feel the crank as it revolved. He had to stoop to feel the crank, and whilst he was so engaged the crank came down on his foot. The crank could have been guarded, and inspection could have been carried out with the guard on, and this would have prevented any accident.

In cross-examination by Mr. Hastings, Witness said his duties were general supervision and acting as chief assistant to Mr. Howes. It was not correct that September 30th was the first date on which he or anyone else suggested that the machinery should be fenced. In the August Bank Holiday week he suggested to Kerr, the foreman fitter, that the machinery ought to be fenced. He had been instructed to try the pump to see if it was satisfactory before it was taken over from Messrs. Isler, the contractors who erected it. Witness admitted writing a series of reports dealing with the working of the pump, and said that from August 18th it was out of commission for repairs, and remained so until his accident. He agreed that on the day of the accident he was testing Messrs. Isler's work to see if it was satisfactory. The pump never was satisfactory. He knew that under the provisions of the Factory Act there was no need to fence machinery under repair, but he did not agree that that applied to the present case. He submitted that the pump ought never to have been allowed to run at all without guards. When Mr. Howes went for his holidays on July 11th, plaintiff was in full control, but the pump at that time was not sufficiently completed to fix a guard. He did not suggest guards in his reports, because he looked on Mr. Howes as a qualified engineer, and in the engineering profession, if an engineer continued to be worried with suggestions, he was apt to get annoyed. In addition, when the foreman fitter went for his holidays he handed him a plan of a proposed guard for the pump, and this was seen by Mr. Howes, and afterwards given back to the foreman fitter. The reason why he declined to go back to Harrod's was because they offered him an inferior position, and he would have had men under his charge getting more salary than himself.

Dr. G. W. H. French gave evidence as to the injury suffered by the plaintiff. John Clutton, foreman to Messrs. Isler, who supplied the pump, was also called by Mr. Hastings.

Mr. W. Howes, chief electrician for the defendants, said that the electrical station of the defendants was an important one, as it supplied all the services of the stores and light and power to the flats around. All the defendants undertook in connection with the pump was the electrical connections. They did not erect the motor. He admitted that there was danger in testing the crank. They could not erect the fence, however, until the pump was taken

over, and at the time of the accident the pump was in Messrs. Isler's hands.

MR. HASTINGS submitted (1) that plaintiff was not a workman within the meaning of the Employers' Liability Act; (2) that under Sec. 10 of the Factory Act, 1901, this was a machine which was not required to be fenced, "being under repair, or under examination in connection with repair"; (3) that plaintiff admitted that he knew of the danger, made no complaint, and undertook the risk; and (4) that plaintiff was guilty of contributory negligence in putting his foot where he did.

DR. KINGSBURY contended that the nature of the plaintiff's work made him a workman, and that there was no repair of the pump in the sense that it would exonerate Messrs. Harrod's from their responsibility to fence it.

The JUDGE, in addressing the jury, said the case had taken up a great deal of time, and was somewhat important, but it really resolved itself into a small compass. In this case the negligence alleged was against Mr. Howes in not having the pump fenced. If the jury found that plaintiff was not a workman within the meaning of the Act, he had no remedy. They had to decide whether he came within the definition of "artificer, handicraftsman or otherwise engaged in manual labour." If they found that plaintiff was one engaged in manual labour, they had to consider the liability of Messrs. Harrod's. They had to decide whether the pump was used in connection with defendants' business, and to consider whether defendants were negligent in not erecting a temporary fencing. Further, they had to consider whether plaintiff, who was a man of intelligence, and had occupied a responsible position at Hornsey, was aware of the danger and undertook the risk.

After consultation in private, the jury held (1) that defendant was a workman under the Act; (2) that the pump was under examination at the time of the accident; (3) that it was a defect that the pump was not fenced; (4) that the defect was due to the negligence of Mr. Howes; (5) that the plaintiff knew and appreciated the risk of the machine being unfenced, and undertook the risk; (6) that the plaintiff was not guilty of contributory negligence; and (7) that the damages (if any) should be assessed at £114 1s.

MR. HASTINGS asked for judgment on the finding of the jury that the plaintiff undertook the risk.

A consultation took place between the parties, and MR. HASTINGS having admitted liability under the Workmen's Compensation Act, it was agreed that plaintiff should receive £16, and that each side pay its own costs.

BUSINESS NOTES.

Consular Notes.—Zanzibar.—The British Consul in Zanzibar, in a recent report, states that a power station has been installed at a cost of £4,000, which supplies current throughout the day and night. The question of fuel presented considerable difficulty owing to the rise in price of both Welsh and Natal coal, and it is possible that petroleum will be adopted. The total number of new lights added during 1912 was 760. Some important changes and improvements have been made in the street lighting of Zanzibar Town, the chief among them being the installation of metallic-filament lamps in the main street. A considerable amount of extension work has been done in the town telephone system. At the end of 1911 there were 54 instruments in all; this system was increased during 1912 to 76; an average number of 380 calls are dealt with during each 24 hours. There are wireless telegraph stations on Pemba and Zanzibar Islands, and the German Government have recently erected a wireless station on the mainland at Dar-es-Salaam, 42 miles from Zanzibar. The range of a new plant is 250 miles under ordinary, and 400 miles under very favourable, conditions. The total number of messages transmitted was 5,312 in 1911, and 4,718 in 1912.

German E. Africa.—The British Vice-Consul reports that there is a double line of telephones between Dar-es-Salaam and Tanga and Dar-es-Salaam and Kilwa, the ordinary telegraph wires being used for purposes of telegraphing and telephoning. Telegrams take precedence over telephone calls. At present there are 3,000 km. of line and 3,000 km. of wire in use; 15 towns have a local telephone service. The local radius is 5 km., and the charge is 150 rupees (£10) per annum, the number of calls being unlimited. For trunk line connection the annual charge is 180 rupees (£12). For night trunk line calls the charge is from 1 to 3 rupees, according to distance, and the line may be held for five minutes, except in the case of Tabora, where the fee is 3 rupees, and the time allowed three minutes. German East Africa is connected with the international cable system by the cable of the Eastern and South African Telegraph from Dar-es-Salaam to Zanzibar *viâ* Bagamoyo. There are 29 telegraph offices in the Protectorate. In March, 1911, Bukoba and Muanza were connected by wireless. The range of the Muanza station is about 900 km., and of the Bukoba station 200 km. A far more powerful installation has now been erected at Dar-es-Salaam, with which it is hoped connection will be established with Guardafui and Delagoa Bay, and with ships at sea at even greater distances than these points. It is hoped that Muanza will be within call from Dar-es-Salaam, at least during the night. The height of the antenna is 100 metres. The Telefunken system is employed. The installation came into operation in March, 1913.

Japan.—The British Consul at Yokohama, in a recent report, states that hydro-electric plant still continues to be imported in large quantities, but as the various parts, such as turbines, Pelton wheels, dynamos, &c., are not given under separate headings in the trade returns, it is difficult to ascertain the actual amount imported. Hitherto, practically all cables imported have been overhead, but underground cables are becoming more popular every year, partly because they are less liable to interruption from atmospheric disturbances, and partly because they obviate the necessity of the countless criss-cross wires which disfigure so many towns in Japan. As long as the change over from overhead wires to underground cables continues, there is likely to be a large yearly import of insulated cables. Although a considerable amount of uninsulated cable is made in Japan, there is still a very large import from abroad, as the Japanese appear to find difficulty in manufacturing cable suitable for high-tension current, for which there is a large demand by hydro-electric works.

Germany.—The Consul at Hamburg reports that the electric railway which encircles that city, partly as an underground and partly as an elevated railway, was opened for traffic in 1912, and has proved a great success, the number of passengers carried being far in excess of what was ever hoped for. Nor, it is understood, has the railway in any way taken away from the number of passengers who use the street tramways, notwithstanding that the trains run more frequently, more quickly and with fewer stoppages and delays than the tramways.

Russia.—The British Consul at Moscow reports that electrical business made great strides in Russia during 1912, in fact, the year created a record. Never before have so many and so large orders been received. These were both private and municipal. All branches of industry gave large orders, and electrical machinery was more in demand than steam. The Government has also begun to give orders for electric power. A sign of the increase of business was that during the year many electrical companies found it necessary to increase their capital, some of them by very large amounts. The Germans are greatly interested in electrical works, and the German banks readily assist in disposing of the new shares. Most of the capital in these companies is non-Russian, and is presumably German.

Honduras.—In a recent report on the trade of Honduras, the British Consul calls attention to the increase of foreign competition which has recently been witnessed. American merchants and manufacturers have been showing a still more active interest in the Honduranean markets during the last year, and commercial travellers have visited the capital frequently and, it is said, with very good results. German commercial travellers have visited Honduras with their usual frequency. Italy is awakening to the possible outlets for her manufactures offered by Honduras, and lately a large departmental store, stocked principally with dry goods and provisions, exclusively of Italian manufacture, has been opened in Tegucigalpa. It is as yet too early to judge of what the results of this venture will be; but if successful there is no doubt that the Italians will take a share of British trade.

British merchants have not much to fear if they will take an interest in the Honduranean markets. As a general rule their prices exclude competition, whereas the qualities continue to enjoy the reputation of being unequalled.

A good deal of correspondence has been received at the Consulate from British manufacturers in regard to trade. Nearly all this correspondence is of a circular letter form, and seldom exceeds a few lines asking if there is an opening for this or that article, and rarely contains any information which would enable a Consul to know just where to look for information that would be of value. If British manufacturers would state more precisely and in a concise form the substance and quality of their goods, and give a few prices of their special lines, it would enable the Consul in making inquiries to ascertain from local merchants their cost prices of the particular articles in which British manufacturers are interested—information which they withhold unless for purposes of comparison. Again, British manufacturers show a marked lack of originality in their printed letter headings. In a great number of instances absolutely no information is to be gathered from these as to what the nature of their business is, and in some cases the references made in the communications are so technical as to be scarcely intelligible. In not a few instances letters have been returned to the Consulate marked "not to be found," due to insufficient address on the letter headings. American and German manufacturers seem to have made a special study of these matters, and from their letters, which are occasionally received at the Consulate, they appear to be very explicit in stating their requirements. In other words, there is a close co-operation between American and German manufacturers and their Consuls, which might with advantage be imitated by British traders. It will be gathered from the tables of imports and exports that the business of Honduras is small, and in a great number of cases it would not be worth the while of British manufacturers to send out commercial travellers to a place so inaccessible as Tegucigalpa, unless such travellers could represent four or five industries.

Formosa.—In a recent report the Consul states that various extensions of electrical power plant are under way. The establishment of a second power plant to serve the capital is contemplated, partly as a reserve against interruption of the original plant by floods, and partly to provide for the continually increasing use of electricity in the vicinity; the cost is estimated at £25,500. A contract has been made for the supply of 4,000 H.P. of turbine machinery for the electric plant in South Formosa, at a cost of £26,000

Catalogues and Lists.—Mr. C. H. Blume, The White Building, Sheffield.—Priced leaflet respecting "Megomac" and "Insulac" insulating varnishes.

Messrs. Ozonair, Ltd., 96, Victoria Street, London, S.W.—New 10-page pamphlet discussing the therapeutical applications of Ozonair apparatus, and illustrating apparatus for hospitals and private sick rooms.

Messrs. Crompton & Co., Ltd., Chelmsford.—Thirty-two-page list in their uniform style, containing a fully illustrated account of their potentiometers and accessories therefor. Half-tone views and many line diagrams accompany the descriptive matter and particulars of tests are given.

The Mica and Standard Insulation Co., 166, Dalston Lane, London, N.—Eight-page price list of Micanite sheet insulation, Micanite tubes, washers, and various standard insulating materials.

Messrs. A. P. Lundberg & Sons, 477 to 489, Liverpool Road, London, N.—Illustrated leaflet No. S36, giving descriptive particulars, dimensions, &c., of standard pattern switchboards for automobile lighting.

Mr. E. J. Gutmacher, 12, Aldgate, London, E.C.—Pamphlet containing particulars of Eastman electric motor-driven cloth-cutting machines, as made by the Eastman Machine Co., of Buffalo, for whom he is sales agent in the United Kingdom.

The Korfund Co., 329, Bank Chambers, High Holborn, London, W.C.—Twenty-page pamphlet concerning the treatment of machine vibration and noise by means of Korfund cork foundation plates. These plates have recently been successfully applied in the insulation of generating sets at many picture palaces where, during performances, silence is, of course, most essential.

The British Prometheus Co., Ltd., Salop Street Works, Highgate, Birmingham.—New catalogue (No. 150) of 60 pages containing excellent illustrations on art paper of a variety of designs of electric heaters. General information regarding the element used, and the power consumption, working instructions, &c., occupy the opening pages, and pictures follow of convectors in copper, brass, cast-iron, plain iron, nickel-faced and other steels for the heating of houses, public buildings, staircases, ships, &c. The lamp radiator section comes next with a number of designs in different styles and finishes for from two to six lamps. Prices, and numerical and code indexes are given.

The International Time Recording Co., Ltd., 151-155, City Road, London, E.C.—Twenty-four page catalogue containing full particulars of their automatic time-recording system, including illustrations of electric time recorders and electric time stamps.

Messrs. Irwin & Jones, London House, New London Street, London, E.C.—Eighteen-page catalogue describing their "Geji" Buffalo belting, belt fasteners, hydraulic leathers, &c. Results of tests are given which show that the average coefficient of friction of the "Geji" belt is 30 per cent. higher than that of double leather, and 42 per cent. higher than that of cotton belts.

Messrs. Walter Newbold & Co., Pearl Buildings, London Bridge, London, E.C.—Forty-four-page illustrated catalogue of machine tools. Full descriptive particulars, dimensions, code-words and prices, and excellent pictures, are given of various lathes, shaping, planing, shearing, screwing and drilling machines.

Bankruptcy Proceedings.—Charles Blake (trading as the Bilston Electrical Co.), electrical engineer, 4, Church Street, Bilston, Stafford.—The first meeting of creditors in this matter was fixed to be held at the Official Receiver's Office, 30, Lichfield Street, Wolverhampton, last week, but only one creditor put in an appearance, and the matter was, therefore, left in the hands of the Official Receiver.

James Clifton Robinson (son of the late Sir Clifton Robinson).—At the Bankruptcy Court, on Monday, the first meeting of creditors was held. The receiving order was made on a money-lender's petition. It will be remembered that debtor's previous failure occurred in 1907, an order of discharge being granted subject to judgment for £2,500. It was stated that in the present instance the liabilities were about £1,100, and that there were no assets. Debtor has lodged a proposal for a cash composition of 10s. in the £. The meeting stands adjourned to January 21st.

The Shipping Exhibition.—We have received a copy of the preliminary list of exhibitors who will be showing at the Shipping Engineering and Machinery Exhibition at Olympia from September 25th to October 17th. The following names appear:—Babcock & Wilcox, Ltd.; Bailey, Sir W. H., & Co., Ltd.; Boby, William; Bonecourt Surface Combustion, Ltd.; British Vacuum Cleaner Co., Ltd.; Coventry Chain Co., Ltd.; Davidson & Co., Ltd.; Electric Appliances Co., Ltd.; Feld Bros. & Co., Ltd.; Hudson Economiser Co. (1907), Ltd.; Jacob, White & Co., Ltd.; Keith, James, & Blackman Co., Ltd.; Kelvin, Bottomley, & Baird, Ltd.; Kennedy, W.; Kynoch, Ltd.; Magic Appliances, Ltd.; Marconi's Wireless Telegraph Co.; Medway's Safety Lift Co.; Ozonair, Ltd.; Parsons Marine Steam Turbine Co., Ltd.; Pinchin, Johnson and Co.; Schmidt's Superheating Co., Ltd.; Stone, J. B., & Co., Ltd.; Stothert & Pitt, Ltd.; Sunderland Forge and Engineering Co., Ltd.; Tackley, W. C., & Co., Ltd.; Telford, Grier & Mackay, Ltd.; Yorkshire Copper Works, Ltd.

Liquidation.—The Grindell-Matthews Wireless Telephone Syndicate, Ltd.—A petition for winding up this company has been presented by Messrs. J. G. Pullen & Sons, of Northampton, creditors, and it is to be heard on January 13th, in London.

Calendars and Diaries.—The Westinghouse Brake Co., Ltd., 82, York Road, King's Cross, N., have circulated a hanging calendar with monthly sheets, on each of which a half-tone illustration appears of the firm's silent rocker-joint chain drives.

Mr. C. H. Blume, of the White Building, Sheffield, has sent us a "Thin" pocket diary for 1914. There is a suitable supply of perforated general memo. pages, followed with a compact diary allowing a month's engagements to the page. There are calendars for 1914 and 1915, an accident insurance coupon, and useful tables of general information.

The Liverpool Electric Cable Co., Ltd., Liverpool, have sent us a calendar with monthly slips for 1914, a view of the works opened in 1912 appearing above the slips.

From the Jandus Arc Lamp and Electric Co., Ltd., Hartham Road, Holloway, London, N., we have received a large and excellent picture reproduced from an original crayon drawing specially prepared for the company by Mr. C. E. Ritchie. Similar in subject to previous souvenirs received from the same company it will likewise be afforded a place of honour. A small calendar is fastened to the top right-hand corner, the name of the firm appearing neatly at the opposite top corner.

The Union Electric Co., Ltd., of Park Street, Southwark, London, S.E., is conveying the compliments of the season to its friends by means of a vest-pocket card and stamp case.

The Nottingham Society of Engineers has issued its diary for 1914. It contains calendars, ample daily spaces, and an accident insurance coupon. It is well bound, with the name of the Society in gilt lettering on the front cover. Particulars of the Society and a list of its members are followed by some 50 pages of engineering advertisements.

Messrs. Twin-Grips, Ltd., 104, Bishopsgate, London, E.C., have issued a delicately got-up little wall calendar for 1914. "Beryl" so absorbs our attention that we almost overlook the little monthly slips at foot.

The White Electrical Instrument Co, of 2 and 4, Gloucester Street, Clerkenwell, E.C., will forward copies of their little celluloid pocket calendars on application.

France.—The French Customs authorities have recently given a decision to the effect that "cables for electrical or other purposes, of iron, steel, copper, &c., wire, insulated or not, rubbered or not, with covering of aluminium, spun or other," are to be classified for purposes of the import duty as "manufactures of aluminium, other," under No. 579 *bis* of the tariff.

Trade Announcements.—To meet the requirements of increasing business in London, the Walsall Hardware Manufacturing Co. are opening a new depôt at Addison Bridge, Kensington Road, W., near Olympia, where communications should be sent. Telephone No. 2461 Western.

With reference to the notice on page 826 of our issue of November 21st, 1913, respecting the firm of Peabody, Rice & Wilson, of Johannesburg, as this is open to misconstruction, we are asked to state that Mr. Wilson, who went out to South Africa in 1896, relinquished his connection with the British Insulated and Helsby Cables, Ltd., in May last year. He subsequently secured the agency of Messrs. Callender's Cable and Construction Co., Ltd., which is now held by the firm of Peabody, Rice & Wilson.

The business of M. K. Cooper & Co., electrical engineers, 27, Oswald Street, Glasgow, has been amalgamated with that of T. C. Smith & Co., electric light, power and motor-car engineers, 21-25, Bon Accord Street, Aberdeen, where all communications may now be sent.

Mr. H. P. Hodge, electrical engineer, of Lower Street, Kettering, has opened a branch business in High Street, Rushden.

New premises in High Street, Chatham, have been opened by Mr. H. Barnes, electric light fitter, late of Watts' Place.

Mr. A. P. Collins, scrap-metal merchant, has removed from New Street to St. Albans Road, Birmingham. Telephone No.: Midland 518; telegrams: "Metalise, Birmingham."

Messrs. Morris & Lister (London), Ltd., of Westminster, announce that their telephone number is now Victoria 7844.

Messrs. David Brown & Sons, Ltd., Huddersfield, have acquired the business and patents of John Sunderland, wheel cutter, Keighley.

The telephone number of the Brompton and Kensington Electricity Supply Co., Ltd., is now Western 1531 (three lines).

The telephone number of the British Economical Lamp Co., Ltd., has been changed from Holborn 2285 to Regent 4912 (two lines).

Book Notices.—"*Journal* of the Institution of Electrical Engineers." Vol. 52, No. 225, January 1st, 1914. London: E. and F. N. Spon, Ltd. Price 3s. 6d.—This issue contains the following papers:—"The Employment of Power in H.M. Post Office," by H. C. Gunton; "Electricity Supply of Large Cities," by Prof. G. Klingenberg; "The Magnetic Leakage of Salient Poles," by Dr. R. Pohl.

"*Journal* of the Institution of Post Office Electrical Engineers." Vol. VI, Part 4. January, 1914. London: H. Alabaster, Gatehouse & Co. Price 1s. net.

"*Journal* of the Society of Engineers." Vol. IV, No. 12. December, 1913. London: The Society. Price 1s. net.

"*Proceedings* of the Physical Society of London." Vol. XXVI, Part 1. December 15th, 1913. London: *Electrician* Printing and Publishing Co., Ltd. Price 4s. net.

"Science Abstracts." Sections A and B. Vol. XVI, Part 12. December 29th, 1913. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

LIGHTING and POWER NOTES.

Accrington.—The expenditure on the new electricity works plant was £15,536, or £866 more than the loan. The estimate for the Mond gas plant was £9,900, and the actual expenditure £9,549. The estimate for the Clayton transmission, &c., including cable, feeders, transformers, was £4,770, and actual expenditure £4,433.

Algeria.—La Société l'Algerienne Electrique has applied for a concession for electric lighting in the town of Misserghin (Oran).

Argentina.—The Government of the Province of Mendoza has approved the project of the Empresa de Luz y Fuerza for a hydro-electric station on the River Mendoza. The dam is to be 1 km. above Cacheuta station, and there will be a tunnel 2,200 m. long to the turbine station. Instead of a retaining wall, a steel cylindrical dock, 25 m. in length × 4 m. in diameter, will be used. The tunnel will have a capacity of 30 cb. m. per second. There will be four turbines of 4,000 H.P. each. The cost is estimated at $7,000,000.—*Review of the River Plate.*

Barton-on-Humber.—E.L. AGREEMENT.—The U.D.C. has transferred the agreement entered into with Mr. F. Hopper to the E.L. Co. formed to take over the undertaking, and has consented to the use of overhead wires.

Bath.—SEWAGE PUMPING.—The Tramways Co. has informed the R.D.C. that it is prepared to supply electricity to the proposed sewage pumping station at Batheaston at 2d. per unit, plus the cost of the service, the supply to be taken from the trolley wire.

Canada.—According to the *Standard*, the Hydro-Electric Commission has announced a further reduction in the price of electricity, which will now range from £3 1s. 10½d. per H.P. in Hamilton, to £6 12s. per H.P. in Baden. The transmission lines from Niagara Falls to Hamilton, and from Hamilton to London and St. Thomas, are to be duplicated at a cost of £123,000. The municipalities are organising to construct electric railways; one is to be built from Toronto to Port Perry, and another through the counties of Wellington, Grey, and Simcoe, to Georgian Bay.

ELECTRIC RANGES.—The *Electrical World*, referring to the question of electric ranges in use in the City of Winnipeg, states that there are approximately 1,000 in use in the city, supplied by the Hughes Electric Heating Co.

Chiswick.—A meeting of the newly formed Ratepayers' Defence Union was recently held, when resolutions condemning the proposed construction of gasworks in the area, and the Council's electricity scheme, were passed, almost unanimously.

Continental Notes.—SPAIN.—A concession has been granted to utilise the water power of the river Mijares at Toga (province of Castellon), in the generation of electricity.

The new hydro-electric generating station established by the Sociedad Fuerza y Riegos del Elbro, at Pobla de Segur, in the province of Lerida, to utilise the Noguera-Pallaresa falls, has been completed. The current is being transmitted for lighting and power purposes to Barcelona, a distance of 106 miles, and for the operation of the Sarria electric railway. The same company is establishing another large hydro-electric station at Seros, 112 miles from Barcelona. It is expected that one of the four 14,000-H.P. turbines and generators that are being installed will be put in operation by the end of the present month.

RUSSIA.—An electric lighting station is to be established in the town of Petrikau.

AUSTRIA.—Plans are being prepard in respect of a scheme to utilise the water power of the River Etsch, near Halzbruck, in the Tyrol, to generate electricity.

FRANCE.—The central station in Valenciennes belonging to the Compagnie Générale pour l'Eclairage et le Chauffage par le Gaz, of Brussels, has recently been taken over by a new company, the Société d'Electricité de la Region de Valenciennes-Anzin, which has a capital of £800,000. The company, which has secured the contract for the supply of electricity to the local tramways, is establishing a new generating station, with a capacity of 20,000 KW.

FINLAND.—It is stated that the committee appointed to investigate the water power of Vuoksen has reported that 90,000 H.P. could be obtained from the Imatra Falls, at a cost of about £880,000. Before the committee could issue a memorandum on the subject, a Franco-Russian company, styled the "Société Sainte Petersbourgeoise de Transmission Electrique de la Force des Chutes d'Eau," applied to the Finnish Senate for permission to survey the territory from Lake Saima to the Kuurmanjoki river, with a view to constructing a channel, and concentrating all the rapids in the Upper Vuoksen into one place. The Senate directed the committee to carry out the survey. The principal power station would be at Kuurmanpohja, where the channel falls 200 ft. The waterfall would afford 300,000 H.P., and would to a very great extent provide power for St. Petersburg, Viborg and the Finnish State Railways. It is estimated that the power station and channel will cost about £4,000,000.—*B. of T. Journal.*

Dartford.—The U.D.C. has approved amended plans for extending the generating station.

Dewsbury.—The T.C. has decided to oppose the Yorkshire Electric Power Co.'s Bill.

Dundee.—NEW TURBINE PLANT.—The T.C. has given Mr. Nairn, chairman of the Electricity Committee, and Mr. Richardson, general manager, powers to purchase a 5,000-KW. turbo-alternator, either by repeat order or otherwise as they may think fit. The results and reliability of the Willans & Robinson turbines were favourably commented on, but no definite instructions were given to the above gentlemen as to placing a repeat order, this being left entirely to their judgment.

Guildford.—The question of whether shareholders in lighting companies, who are members of town councils, should vote on the reports of the lighting committees, was raised at the last meeting of the Corporation. Following a discussion as to the lighting of certain streets in the borough, Alderman Patrick, J.P., asked if shareholders in lighting companies had any right to vote. Councillor W. Shawcross said he had noticed that two or three shareholders in lighting companies had voted. The town clerk said that the section of the Act stated that no member should vote on any matter in which he was directly or indirectly interested. Councillor Froome suggested that the voting (on the question of whether or not the Committee's report should be adopted) should be taken again. The Mayor said he did not know who were shareholders of companies. He could not stop them. He should not take the vote again.

Halifax.—The Corporation has fixed the charges for electricity for lighting purposes at 4d. per unit up to 1,200 units per quarter, and 2½d. per unit in excess of 1,200 units.

Hemsworth.—E.L. SCHEME.—The D.C. has decided to support the Yorks. Electric Power Co. in its application for powers to supply electricity for lighting purposes, it being stipulated that by doing this the Council did not grant a monopoly. A letter was read from Mr. T. Charlton, electrical engineer, of South Elmsall, in which he suggested the promotion of a local company, and he was requested to submit his proposals, and to state whether he expected to be granted a monopoly.

Highbridge (Somerset).—E.L. SCHEME.—The Burnham D.C. has asked the Highbridge Council to discuss with it the formation of an E.L. Co. for the latter town.

Hove.—THE E.L. PURCHASE.—It is understood that the price to be paid by the T.C. for the purchase of the local E.L. Co.'s undertaking is approximately between £175,000 and £176,000, and that a capital expenditure of £20,000 will be needed to bring part of the plant up to date.

Hoyland.—E.L. SCHEME.—A deputation of the D.C. which waited upon the Yorks. Electric Power Co. in reference to its application to supply electricity in the district, was unable to obtain a stated price for the supply, owing to the manager's desire to submit a scheme to the directors before deciding. The deputation gathered that the price would be very favourable, and it would probably be possible to supply cottages with electricity at 6d. per week. The deputation guaranteed to take a minimum of 30,000 units, and stated that if at any time the Council felt that it would be to its advantage to install its own plant it would do so.

Little Boyton.—The Coventry E.L. Committee has consented to the P.C. entering into an agreement with the Exhall Colliery Co. for electricity supply in the parish, which is in the Coventry area.

London.—ISLINGTON.—L.G.B. INQUIRY.—A private inquiry was held on December 30th into the proposal of the B. of G. to install electricity at several of its institutions. The inquiry resulted from the petition of a minority, the majority of the board having decided in favour of E.L.

STEPNEY.—The Finance Committee has recommended the B.C. to authorise it to take up a further £10,000 for the purposes of the electricity undertaking, out of the £25,000 for which sanction was obtained in July last year. The Port of London Authority has increased the assessment on the four suction pipes at Limehouse station from £85 to £200 per annum. The Electricity Supply Committee has recommended the Council, subject to the approval of the B. of T. and the L.C.C., to enter into an agreement to give a temporary bulk supply to the Shoreditch B.C. The proposal is for one year from September, 1914, and for an optional supply in the second year. This will temporarily defer the carrying out of the Shoreditch Council's extension scheme pending consideration by the L.C.C. of the report on the whole question of London's electricity supply.

Maidenhead.—ELECTRIC COOKING, &c.—The electrical engineer has informed the T.C. that there is a growing demand for electricity for heating and cooking purposes, and advices that during certain hours of the day electricity could be sold profitably at 1d. per unit. The Electricity Committee and the engineer have been asked to recommend contracts for current for domestic purposes other than lighting, and for battery charging, based upon the engineer's figures and conditions contained in his report.

Mutford and Lothingland.—PROV. ORDER.—The Oulton Broad Electricity Co. has notified the R.D.C. of its intention to apply for a prov. order for E.L. at Oulton Broad and Carlton Colville.

Oldcastle (Co. Meath).—PROPOSED E.L.—At the last meeting of the R.D.C. it was stated that the estimated initial cost of the E.L. scheme was £2,000. The Council decided to advertise for a consulting engineer.

Penistone.—The Yorkshire Electric Power Co. has asked the R.D.C. to support its application to supply electricity for lighting purposes.

Penybont.—PROV. ORDER.—The R.D.C. has consented to the South Wales E.P.D. Co. obtaining a prov. order for E.L. in its area.

Port Glasgow.—PROV. ORDER TRANSFER.—The T.C. has signed the deed of transfer of the E.L. order to the Greenock Corporation, which is establishing two sub-stations in the area.

Rochdale.—NEW LOANS.—The recommendation that sanction be sought for the borrowing of £68,000 for extensions to plant at the electricity works came before the T.C. on January 1st, and was agreed to. Councillor Walker said that since the present growing demand began to be made on the works, the plant had never been able to keep up with it, and the additional capacity now proposed was spoken for. The extensions were to be made on the present site in Dane Street, and, when completed, that site would be fully occupied. Councillor Richmond was informed that there was no likelihood of a reduction in the price of electricity in the near future.

Shipley.—L.G.B. INQUIRY.—An inquiry was held by Mr. T. C. Ekin, on Tuesday, into the application of the U.D.C. for power to borrow £27,000 for extensions, mainly in connection with the electricity undertaking. Mr. W. Redman stated that the electricity works could not meet the applications of several firms for a supply, and had no reserve in the event of one unit giving out. It was proposed to supply the outlying districts with A.C., and the centre of Shipley with D.C.

South Africa.—The Prince Albert municipality is to spend £10,000 for various improvements, including an electric light installation.

Boksburg Municipality proposes to spend £100,000 on improvements, including tramways and electric light extensions.—*B. and S.A. Export Gazette.*

South Stoneham.—PROPOSED E.L.—The R.D.C., having been informed that the Southampton T.C. proposes to supply electricity to Bitterne for public lighting, has arranged for a conference to take place with representatives of the T.C. and the Bitterne P.C., which, it appears, has no power as yet to undertake public lighting out of the rates.

Southborough.—PROPOSED E.L.—The U.D.C. has asked the Tunbridge Wells T.C. on what terms it is prepared to supply electricity to the district.

Stainland.—The U.D.C. has decided to oppose the application of the Yorks. Electric Lighting Co. in its Bill for powers to supply the district with electricity for lighting purposes.

Todmorden.—LOAN SANCTION.—The L.G.B. has sanctioned the borrowing of £8,050 for extensions at the electricity works, &c.

Virginia (Co. Cavan).—E.L. SCHEME.—The Castlerahan R.C. has passed a resolution that powers be sought to exercise the rights of an urban authority for the purpose of carrying out an electric lighting scheme for Virginia.

Warminster.—PROV. ORDER.—The R.D.C. on December 30th, considered the application of Mr. J. H. Edwards for consent to a prov. order for E.L. in its area. The chairman said the Council ought to inquire into the prices for current, which seemed to be high compared with other parts of the county, while there was also the question of overhead or underground wires. It was stated that the U.D.C. was taking the matter up. It was decided to fully discuss the matter at the next meeting.

Warrington.—PLANT EXTENSIONS.—The electrical engineer has been instructed to report upon the provision of additional feeders. A deputation has been appointed to interview the L.G.B. with reference to the loan for the extension of the electricity works and plant.

York.—ELECTRIC COOKING.—The Visiting Committee of the City Asylum has decided to install an electric fish-frying apparatus at a cost of £38.

TRAMWAY and RAILWAY NOTES.

Accrington.—NEW CARS.—The T.C. is being recommended to apply for sanction to borrow £1,600 for the purchase of new cars. It is proposed to invite tenders for three single-deck cars, and two double-deck cars of the radial truck type. Vestibule fronts are to be fitted for a 12 months' trial.

Ashton.—The first year's working of the lease under which the Ashton and Hurst tramways are being operated, shows that it has been the most successful in the history of the Hurst tramways.

Bolton.—The Corporation is promoting a Bill for the construction of tramways, and the conferring of further powers with respect to electricity.

Birmingham.—OMNIBUS PURCHASE.—It is estimated that the purchase price to the City Council of the undertakings of the Birmingham and Midland Motor Omnibus Co. and allied companies will be £34,000, viz., £20,600 for the 30 omnibuses, £10,000 for the garage, and £3,400 for the plant. The Finance Committee does not object to the proposal.

Burnley.—YEAR'S WORKING.—During the year just concluded 15,949,359 passengers were carried on the Corporation tramways, and the receipts were £79,641. The success of the present tramways has influenced the Committee to go into the question of providing a service in other districts. The Committee favour the present system rather than the adoption of railless traction or motor-buses.

Continental Notes.—FRANCE.—The electrification of the second network of the tramway system of the Société des Paris Tramways, which includes the lines which run to the Madeleine, the Opera, La Trinité, and the Place de la Republique is approaching completion.

SPAIN.—A company is in course of formation at Vigo, with a capital of £140,000, to construct and work an electric tramway between that town and Mondariz.

Guiseley.—LEEDS TRAMWAY EXTENSION.—The U.D.C. has consented to the proposed extension of the Leeds Tramway in the Guiseley area.

Hastings.—THE DOLTER SYSTEM.—The B. of T. issued a formal order last week to discontinue running the Dolter tramways along the Hastings-St. Leonards sea-front, the notice to take effect forthwith. The tramways were still running on Monday, according to our correspondent, apparently in defiance of the order, pending instructions from the directors. The latter are expecting a Tilling-Stevens petrol-electric tramcar to be delivered immediately, this being the first of 20 such cars on order, with which the route will be worked in future. The Dolter system has been in use for seven years.

Japan.—The Tokio Muncipal Council has just rejected a scheme for the construction of a suspended mono-rail electric tramway to connect Ueno Park with Asakusa Park.

L. & Y. Railway Electrification.—The directors of this company have decided to electrify the 9½ miles of line from Manchester to Bury, *via* Heaton Park and Radcliffe, and it is expected that the work will be completed in a year. A 10-minute service to Radcliffe is proposed. The trains will be operated on the direct-current third-rail system, as used by the company on its Liverpool-Southport lines. A correspondent states that the company will provide its own power plant.

Liverpool.—TRAFFIC CONGESTION REPORT.—In October last the tramways manager (Mr. Mallins) was instructed to report on the question of overcrowding on the tramways. The report, which has now been issued, points out the difficulty of catering for the "rush" traffic at certain times of the day by adding more cars on the already congested routes. He considers that this could best be dealt with by increasing the carrying capacity of all future cars, so as to obviate standing, and points out that the Committee is experimenting with a type of car which he believes will meet the requirements. The congested condition of the two existing routes to the Landing Stage through the central area of the city makes it almost impossible to run extra cars and maintain regularity in service, and he suggests that the Committee might consider the advisability of constructing a third route to the Pierhead through the central area, either through the streets or through a subway, from the Old Haymarket to the Landing Stage, which would greatly relieve the tramways in Lord Street and Dale Street. Either scheme would be costly, but Mr. Mallins states that the congestion problem is becoming so acute that it cannot be much longer delayed.

In connection with this proposal he states that the Tramway Committee may consider the whole question of cross-river traffic, and points out the lack of modern transport facilities between the Lancashire and Cheshire sides, for both passenger and vehicular traffic. A bridge across the Mersey, with connections to Birkenhead and Wallasey, would be 3,450 yards long, and would cost 5 to 6 million pounds, and as the traffic on the Wallasey and Birkenhead ferries only amounted to 30½ million passengers in 1912, and about 850,000 vehicles, he concludes that such an enterprise would not be self-supporting for many years.

As an alternative, a subway or tunnel from the Haymarket to the Landing Stage could be continued under the river to the Cheshire side, to Seacombe, with a branch to Birkenhead. It could be constructed to carry an electric railway or tramway, and provide for vehicular and pedestrian traffic, and a railway could be carried across the Wirral Peninsula to the Dee. Such a tunnel would be about 2½ miles long, costing, say, 3 million pounds.

Mr. Mallins estimates that the financial charges would be met with a traffic of about 45 million passengers at 1d. each, and a million vehicles at 1s. each, and considers that such a scheme would be successful in a few years' time.

Leeds.—The first attempt during the Leeds municipal strike to do serious damage to Corporation property, was made on Tuesday night, when an explosive was thrown at the door of the boiler house at the Crown Point tramway power station. The striker (for it must be a striker), evidently chose his time well and threw the bomb when no one inside the works could have been near. The perpetrator of the outrage has not been traced up to the present.

London.—A system of workmen's "through" fares on the Bakerloo, Piccadilly, Hampstead, Central London and City and South London Railways came into operation on January 1st. The two new tunnels on the District Railway at Earl's Court were brought into use for the first time on Saturday morning last.

Considerable interest attaches to the proposals of the London Fire Brigade for substituting motor appliances for horse-drawn appliances. The proposals involve the use of battery-driven, petrol-

electric and petrol vehicles, and the complete cost is put at £160,000. Owing to the superior efficiency of the power-driven vehicles, several existing fire sub-stations will be abolished.

WOOLWICH.—The B.C. has agreed to a proposal of the L.C.C. to extend its tramways on the overhead system in order to link up with the tramways of the Erith U.D.C. at Abbey Wood.

N.W. RAILWAY ELECTRIFICATION.—The Oerlikon Co. is equipping 43 motor coaches, 38 trailers and 38 driving trailer coaches in connection with this scheme; Messrs. Siemens Bros. also have an order for four train equipments.

Northampton.—The Tramways Committee has approved the designs for new tramcars, and instructed the Sub-Committee dealing with the question to obtain tenders for these and also for the generators, battery and other plant, and for the erection of the car shed.

Nottingham.—TRAMWAY EXTENSIONS.—The extension of the tramways from Carlton Hill to Newgate Street, and from Sherwood terminus to Daybrook is to be proceeded with. A portion of the work on the Carlton Road section has already been completed. It is also proposed to extend the tramways along Derby Road to the bridge over the River Leen, near the entrance to Wollaton Park.

The newly completed section of the Notts. and Derbyshire electric tramway system between Ripley and Nottingham was opened on Friday last. The villages and townships served are Cinderhill, Kimberley, Eastwood, Langley Mill and Heanor. The company's system connects with the Nottingham Corporation system at Basford, and cars run into the city as far as Parliament Street.

Southend-on-Sea.—BATTERY 'BUS.—We learn that the Corporation has placed an order for an electric motor-'bus with Edison Accumulators, Ltd.

U.S.A.—A recent return places the number of electric battery vehicles in use in Philadelphia at the present time at 872; of these 480 are of the industrial and 392 of the pleasure type.

Warrington.—Out of the revenue of the tramways undertaking for the year ended March 31st, 1913, £1,500 has been carried to the relief of the rates. The Council has approved the proposed alteration of the track in Knutsford Road, and estimates are to be obtained for the work.

TELEGRAPH and TELEPHONE NOTES.

China.—It is reported from Shanghai that the telephone exchange at Suchou, which has been in operation for some years, but has not proved a paying concern, is to be handed over to the management of the Siemens-Schuckert Co., of Berlin, under a 10 years' concession. It is also stated that this company is arranging to establish trunk telephone lines between Suchou and Nanking, and between Suchou and Shanghai.

Germany.—It is said that an interesting application of the telephone is being made in connection with the electric tramways in Frankfort-on-the-Main. On some of the suburban lines there are no telephone call offices; consequently, to enable the conductors to communicate with the car-sheds, should any breakdown occur, the tramcars are being fitted with telephones, by means of which, through the medium of the overhead conductor, they can call up headquarters.

Hull.—The Corporation on January 5th decided to purchase from the Post Office the telephone undertaking in its own area at a price of £193,000. The licence will run for 21 years.

The rates offered by the Corporation are lower than those of the Post Office; for 15 calls a day the latter charges over £15, and for 20 calls a day £21, whereas the Corporation gives an unlimited service for £8 a year, and an unlimited residential service for £5 10s. a year. Hull will be the only town in the United Kingdom conducting its own telephone service.

Japan.—As a result of negotiations with the Great Northern Telegraph Co., the Japanese Department of Communications proposes, during the current year, to lay a submarine cable between Nagasaki, Japan, and Shanghai, China, at an estimated cost of £150,000.

Railway Signalling.—In his report on the collision at Waterloo Junction Station on October 25th, Major Pringle states that the railway company intends to employ the track-circuit system between Waterloo Station and Waterloo Junction, which will prevent the recurrence of a similar accident in that section; but he strongly recommends the use of the track circuit throughout the viaduct between London Bridge and Charing Cross.

Switzerland.—A considerable extension of the trunk telephone system in Switzerland is contemplated during the current year, a sum of £74,640 having been allotted for the work.

The Telephone Service.—With the New Year a new Victoria exchange was brought into use in Westminster, and within a few months a large exchange called "Museum" will be opened in Bloomsbury.

The existing Holborn exchange, though a modern one, has proved inadequate for the traffic, and the Post Office has purchased the Inns of Court Hotel for the purpose of constructing a new and exceptionally large exchange on the site, in the course of the next year or so

CONTRACTS OPEN and CLOSED.

OPEN.

Accrington.—Corporation. Three single-deck and two double-deck tramcars of the radial truck type. A sub-committee is to inspect such cars recently supplied to Doncaster.

Australia.—SYDNEY (NEW SOUTH WALES).—March 18th. For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" to-day.

March 2nd. Sydney Harbour Trust. Circular Quay. Three electrically-operated semi-portal travelling cranes for Berths Nos. 1, 2 and 3, Woolloomooloo Bay. Particulars from Engineer-in-Chief of the Trust.

March 25th. N.S.W. Railways and Tramways Department.—Five 1,000-KW. sub-station units to specification No. 124. Particulars at Electrical Engineer's Office, 61, Hunter Street, Sydney.—*Tenders.*

ADELAIDE.—February 11th. P.M.G. 50 cable terminals. See "Official Notices" to-day.

MELBOURNE.—January 24th. Corporation. House cut-out boxes and replacement wedges; January 21st, 5 tons, 16 cwt. bare hard-drawn copper cable. See "Official Notices" to-day.

February 17th. P.M.G. Cable boxes. See "Official Notices" to-day.

Austria.—VILLACH.—January 15th. Supply of an electrically-operated travelling crane, transmission material, &c., to the Knitterfeld Railway machine shops. Particulars (enclosing postage, 20 heller) from the K.k. Staatsbahndirektion in Villach.

VIENNA.—January 26th. The K.k. Nordbahndirektion contemplate altering the present steam power working of the two 30-ton cranes on the Vienna goods station, and invite suggestions and tenders for electric, steam or hand working. Plans, &c., from the Abteilung für Bau und Bahnverhaltung der K.k. Nordbahndirektion in Vienna.

Belfast.—January 28th. Electric cables, for the Harbour Commissioners. See "Official Notices" to-day.

Bolton.—The Electricity Committee has decided to invite tenders for the work of bunker construction at Back-o'-th'-Bank.

Bradford.—January 22nd. Corporation. Surface condensing plant for 5,000-KW. live steam turbo-generator. See "Official Notices" to-day.

Brentwood.—January 17th. Petrol-driven electric lighting plant (50 lights) for Branch Asylum, Harold Court, Harold Wood. See "Official Notices" January 2nd.

Croydon.—January 26th. Corporation. Stores for Tramway Department. Tramway Manager.

Doncaster.—The T.C. has decided to invite tenders for tramway rails and accessories as soon as the sanction of the Board of Trade is obtained to the tramway extensions at Brodsworth and Warmsworth.

Dundee.—January 30th. Corporation (*a*) 5,000-KW. steam turbine and alternator; (*b*) condensing plant; (*c*) 750-KW. rotary converter, with transformer. See "Official Notices" Jan. 2nd.

Guildford.—Condensing plant, barometric type, for Guildford Electricity Supply Co., Ltd. See "Official Notices" to-day.

Ipswich.—January 31st. Corporation. (*a*) Three-phase 300 K.V.A., 3,300-volt alternator, rotary converter with transformer, A.C. booster and C.C. exciter, automatic voltage regulator and booster, cable connections. (*b*) Three 50-K.V.A. three-phase transformers. (*c*) H.T. three-phase main switchboard. (*d*) H.T. and L.T. switchgear. (*e*) Two motor or rotary converters, each 250 KW. See "Official Notices" January 2nd.

Italy.—January 23rd. Italian Ministry of Marine. Electric lamps and electroliers. Upset price (£5,200); deposit 10 per cent. Foreign *manufacturers* allowed to compete. Tenders to: Al Sig. Direttore Generale dei Servizi Amministrativi, Ministero della Marina, Rome.

Leeds.—January 15th. Construction of portions of tramway track in Sovereign Street and Swinegate. Mr. J. R. Hamilton, General Manager.

Leigh (Lancs.).—January 23rd. Corporation. One 1,500-KW. turbo-alternator (impulse type turbine), 1,000-KW. rotary converter, transformers and switchgear. See "Official Notices" to-day.

London.—L.C.C.—January 13th. Installation of 130 lighting points at Popham Road Elementary School, South Islington. See "Official Notices" December 19th.

January 20th and 21st. Installations at Vernon Square Elementary School, Finsbury, E.C. (241 wiring points and 318 lights), and at Raneleigh Road Elementary School, Pimlico, S.W. (210 wiring points, 258 lights). See "Official Notices" Jan. 2nd.

January 27th. 584 tons of special section rolled steel bar for magnetic brake shoes. Chief Officer, L.C.C. Tramways, 62, Finsbury Pavement, E.C.

ISLINGTON.—January 28th. Corporation. Twelve months' supply of electrical and engineers' stores. See "Official Notices" January 2nd.

ST. MARYLEBONE.—February 11th. Corporation. Underground cables, house cables, flexible cords, rubber goods, box compound and insulating materials, &c. See "Official Notices" to-day.

KENSINGTON.—January 29th. Board of Guardians. Electric lamps and fittings and other stores. Specification. &c., from Mr. W. R. Stephens, Guardians' Offices, Marloes Road, Kensington, W.

The Edison & Swan United Electric Light Co., Ltd., have been appointed contractors for 1914 for the supply of Royal Ediswan lamps to the British India Steam Navigation Co.

Manchester.—January 9th. High and low tension switchgear.

January 16th. Water coolers at Stuart Street generating station. Specifications and form of tender obtainable from Mr. F. E. Hughes, Secretary. Electricity Department, Town Hall.

January 20th. (*a*) Tramcar trucks; (*b*) motors and controllers for tramcars. Mr. J. M. McElroy, General Manager, Corporation Tramways.

New Zealand.—January 30th. Fielding Borough Council. Two Diesel engines, A.C. generators, 2,400 volts single-phase 50 periods, exciters, switchboard, fuel storage tanks, crane, &c. Further particulars are given in the *Board of Trade Journal*.

Northampton.—January 12th. Corporation. Double line of tramways to Far Cotton and doubling of section of Kingsthorpe route, also the necessary overhead equipment, underground feeders, telephones, &c. Specifications (£5 deposit) from Mr. A. Fidler, Borough Engineer, Guildhall.

Plymouth.—January 19th. Corporation. Twelve months' supply of arc lamp carbons, electricity meters, transformers, cables, &c. See "Official Notices" January 2nd.

Pontypridd.—January 19th. Complete electric light, telephone and fire alarm installation, workhouse, for the B. of G. A. L. Thomas and G. S. Morgan, architects, Gelliwastad Road, Pontypridd.

Preston.—The T.C. has confirmed a proposal of the Tramways Committee to obtain tenders for the supply of six new cars.

Rochdale.—Corporation. Engine-room extension, new boiler house, &c., turbo-alternators, turbo-alternator condensing plants, water-tube boilers and boiler house equipment. See "Official Notices" to-day.

Salford.—January 12th. Corporation. Three-phase extra high-pressure and medium-pressure switchgear, also two 300-K.V.A. three-phase transformers. See "Official Notices" January 2nd.

Spain.—January 20th. Municipal authorities of Villarubia de los Ojos (Province of Ciudad Real). Concession for the electric lighting of the town during a period of 20 years.

January 19th. Municipal authorities of Culler Baza (province of Granada). Concession for the electric lighting of the town during a period of seven years.

Tenders have lately been invited by the municipal authorities of Villanubla (province of Valladolid) for the concession for the electric lighting of the town.

St. Albans.—January 14th. Electric light installation, workhouse, for the B. of G. Mr. E. F. W. Hicatt, Clerk, Chequer Street.

Stockport.—January 19th. The Corporation Tramways Committee invite tenders for one overhead equipment motor-driven tower wagon. R. Lomax, tramways electrical engineer, Millgate, Stockport.

Turkey in Asia.—March 14th. Forty years' electric lighting concession for Trebizond municipality. Population 50,000 to 60,000; 12 miles of street lighting. Houses mostly occupied by poorer classes. Water power (Deirmen River) available. An English translation of the conditions may be seen at the Board of Trade Commercial Intelligence Department in London.

West Hartlepool.—January 21st. Corporation. Tramway employés' uniforms, tramway tickets. See "Official Notices" to-day.

Wolverhampton.—January 19th. Corporation. Two water-tube boilers complete with superheaters and mechanical stokers. See "Official Notices" January 2nd.

CLOSED.

Australia.—P.M.G.'s Department, Victoria :—

1,700 magneto bells, £657: 150 micro-telephones, £112; 250 microphones, £62; 160 switches, with 1,000-ohm magneto bells and shutters, £126; 25 magneto wall-pattern switchboards, £817: 400 ditto, common-battery, with extensions and exchange lines, £3,303.—J. Bartram and Sons, Pty., Ltd.

475 switchboards, with extensions and exchange lines, £9,955.—Western Electric Co. (Aus.), Ltd.

2 miles silk and cotton-insulated, light lead-covered switchboard cable, 13 pairs, £124; 3 miles ditto, 26 pairs, £336; 2 miles ditto, 52 pairs, £404; 3 miles switchboard cable, 52 pairs, £594; 6 miles paper-insulated, lead-sheathed cable, one pair, £90; 4 tons H.D. copper wire, 100 lb. per mile, braided, £396.—Australian Metal Co., Ltd.

460 electrically-controlled coin collecting devices, £1,322.—Boehme and Owen.—*Tenders.*

P.M.G.'s Department, South Australia :—

Telephone material.—J. Bartram & Son, Pty., Ltd.—800 common battery wall-pattern telephones, £1,397; 200 ditto, with generator, £564.—*Tenders.*

Bath.—Messrs. Chamberlain & Hookham, Ltd., have received the contract to supply the Corporation with D.C. meters for the coming year.

Bedford.—The L.G.B., having refused sanction to a loan for the erection of a new Diesel oil engine plant by a Bedford firm, the Committee subsequently reported in favour of an alternative scheme for the installation of a 1,000-KW. mixed-pressure turbo-alternator with condenser, air filter and accessories. This scheme has since been sanctioned by the L.G.B., and on Wednesday the Committee reported upon the tenders.

The tenders for No. 1 contract for turbine, alternator, &c., varied from £5,938 to £8,353. The Sub-Committee were of opinion that the lowest tender was satisfactory in every respect, and unanimously recommended it for acceptance. For No. 2 contract, which included the boiler, superheater, mechanical stoker, settings, fittings, and coal-handling plant, the tenders ranged as regards the best combination from £2,116 to £3 833. Between the first and second combinations there was a difference of only £13, and as the latter was superior from an engineering point of view, the Sub-Committee recommended its acceptance, that was to say, as follows :—For boiler with fittings and settings, £1,146; for superheater, £115; for mechanical stoker and coal-handling plant, £868; total, £2,129. Contracts Nos. 1 and 2 would, therefore, amount to :—No. 1, £5,938; No. 2, £2,129; total, £8,067; as against £8,000 allowed for in estimate.

Alderman Kilpin said that the carrying out of these proposals meant the saving on fuel of at least 15 per cent., or £1,000 a year on their present rate of consumption, or a sufficient saving to more than cover the repayment of capital and the interest on the loan.

In reply to questions, Alderman Kilpin said the tenders were advertised, it was open tendering, and they had estimates from all those in a position to tender, and the tenders were remarkably close. Contract 1 has been placed with the British Westinghouse Electric and Manufacturing Co., Ltd., and Contract 2 was divided between three firms, viz., for boiler and settings, Stirling Boiler Co., Ltd.; for superheater, the Superheater Units, Ltd., Swansea; for mechanical stoker and coal-handling plant, T. & T. Vicars.

Belgium.—Three firms—one each Belgian, German and French—submitted tenders last week for the supply of the electrical plant required at Ostend for the operation of a drawbridge at the outer port, of two lock gates and two small bridges at the maritime dock. The lowest offer was that of the A.E.G. Union Electrique, of Brussels.

Bradford.—The tender of Mr. Charles Bell has been accepted by the Guardians, at £33 10s., for the installation of an electric fan in the pump room at the workhouse.

Burnley.—The Corporation has accepted the tender of the British Westinghouse Co., Ltd., for plant for the new station, for £2,864; and that of the B.I. and Helsby Cables, Ltd., to supply 2,100 yards of '1-in. cable, and 1,050 yards of '25-in.cable.

France.—La Société du Gaz de Paris has lately placed a contract with the Compagnie Thomson-Houston for the establishment and equipment of two transformer stations at Clichy and Landy, near Paris, to convert H.T. alternating current to L.T. continuous.

Italy.—The management of the Italian State Railways have placed orders for 77 electric locomotives with the following firms :—41 to the Italian Westinghouse Co.; 18 to the Tecnomasio Italiano; and 18 to the Costruzioni Meccaniche di Saronno. Thirty-seven are to be of the type 0-5-0, and the remainder high-speed engines.

Kingston-on-Thames.—The T.C. has accepted the tender of the Crypto Engineering Co. for a 30-ampere motor-generator for charging secondary batteries, at £24.

Merthyr Tydfil.—The B. of G. has accepted the tender of Messrs. J. J. Blackburn & Co., of Cardiff, for lightning conductors at the Cottage Homes and Tydfil Home, at £53 9s. 6d. Other tenders were :—

Dixon & Co bett and R. S. Newall & Co., Ltd.	£75 10 0
Cook, Wreford & Co.	71 5 0
R Anderson & Co.	70 0 0
Mr. Rhys Lewis	70 0 0
W. J. Furse & Co., Ltd.	64 7 6
Mr. W. Larkins	63 15 0

New Zealand.—The Auckland City Council has accepted the following tenders for electric cables :—Lawrence & Hanson Electrical Co., Ltd., £229; Noyes Bros., Ltd., £167.—*N.Z. Shipping and Commerce.*

Salford.—The T.C. has accepted the tenders of Mr. Bertram Thomas, at £149 10s., for certain extensions in connection with the lighting and power switchboard, and at £65 for the supply of an additional circuit-breaker for the temporary traction switchboard. The tender of the Curnon Steam Meter Co., Ltd., has also been accepted, at £95, for the supply and fixing of three steam meters for the turbines at the electricity station.

Stockport.—The B. of G. has accepted the tender of Messrs. W. A. Shaw & Co., for extending the telephones at the Union offices.

Wimbledon.—The T.C. has accepted the offer of Messrs. E. Bennis & Co., Ltd., for a "Bennis" chain mechanical grate stoker for a boiler at the electricity works for £204. The tender of Messrs. Cory Bros. & Co., Ltd., has also been accepted for the supply of 2,000 tons of 2-in. "Nailstone" slack for the electricity works, at 14s. 9d. per ton.

THE RJUKAN NITRATE WORKS AND ELECTRICAL PLANT.

II.—THE NITROGEN WORKS.

[BY OUR SPECIAL CORRESPONDENT.]

IN our last issue we gave some particulars of the first power plant installed at Rjukan; the present article deals with the utilisation of the electrical energy generated there, in the huge factories which have been erected at Saaheim, for the production of nitrates of lime and soda by the decomposition of air.

Some idea of the progress made in the nitrate industry will be gathered from the fact that the first Birkeland-Eyde plant was completed in July, 1903; the capacity of this plant was 25 H.P., and it employed two men and two officials. In the same year another 150-H.P. plant was ready, and was followed by a 1,000-H.P. plant in 1904. In 1905 the first factories at Notodden, with a capacity of 2,500 H.P., were at work, and these now employ 65,000 H.P., and are to be further extended to 95,000 H.P. In the meantime, the harnessing of the Rjukan Falls was going forward, and in 1911 the factories were brought into use, employing energy amounting to nearly 150,000 H.P. At these works two different types of electrical furnace are employed, viz., the Birkeland-Eyde and the Schönherr-Hessberger.

In the Birkeland-Eyde furnace, of which there are eight in use, as shown on page 60, the arc is formed between the points of electrodes placed close to each other in a strong field produced by electro-magnets on either side of the furnace. With alternating-current, semi-circular arcs are formed alternately on opposite sides of the electrodes due to the action of the magnetic field, the extreme rapidity of making and breaking leaving the impression of a disk of light.

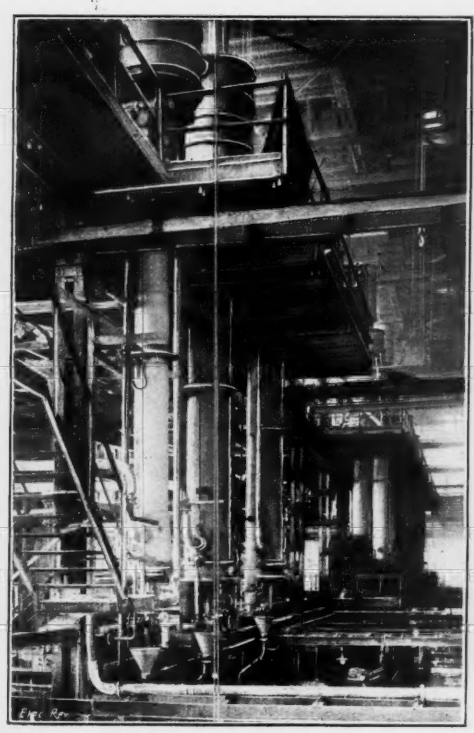
The electrodes are of thick copper tubing, water cooled; the furnace is a narrow circular chamber measuring only a few centimetres in width, with a diameter of 3 m.

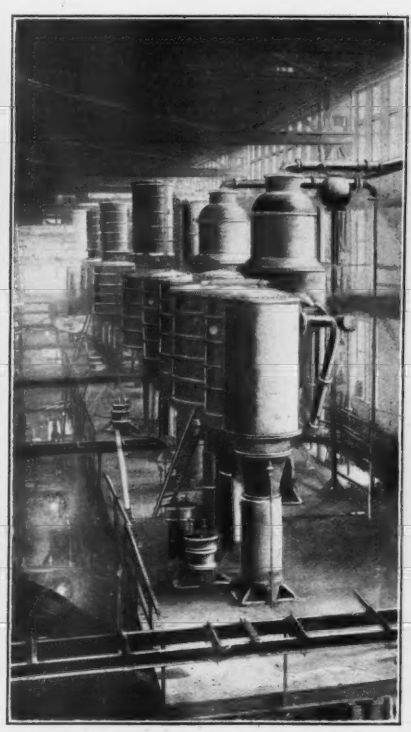
The furnaces are lined with fire brick, openings being left for the admission of the necessary air. The nitrous gases formed in the chamber, are allowed to escape through a firebrick duct outside the casing of the furnace. Current to each furnace is supplied through a choking coil, which keeps the flame steady and uniform. The results obtained from the working of the Birkeland-Eyde furnaces have been very satisfactory, and they have run for weeks without any noticeable change in the flame or regulation; the maintenance of the furnaces has proved an easy matter, and the repairs have been small. The electrodes require attention every third or fourth week, when small portions of them have to be renewed; the furnace linings are renewed every fourth or sixth month.

From the very small furnace, consuming only a few horse-power, this type of furnace has been increased in size to the 5,000-H.P. units now in operation at Rjukan I.

The Schönherr-Hessberger furnace is constructed on an altogether different principle. Instead of

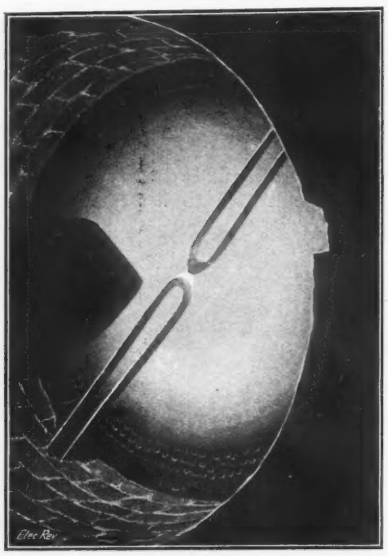
VIEW OF SAAHEIM, SHOWING THE NITRATE WORKS.





TWO VIEWS OF THE EVAPORATING PLANT AT SAAHEIM.

the disk of flame, this furnace utilises a long slender arc in a small-diameter iron tube, through which a current of air is forced. The type of furnace installed at Rjukan I



View of Electric Arc, Birkeland-Eyde Furnace.

consists of a somewhat slender vertical cylinder of iron plate, 7 m. high; in the interior is a tube, forming a reaction chamber, while other tubes serve for the entrance of the air, and its exit after having come into contact with the flame. The arrangement avoids loss of heat, as the entering air current is heated by the escaping gas. The principal electrode is placed at the lower end of the furnace, and can be moved upwards as it gradually burns away in the flame.

The reaction tube forms the second electrode, means being provided for striking the arc by bridging over the gap between the lower end of the reaction tube and the first-mentioned electrode. The air current is forced into the lower part of the furnace, and conducted through the channels, entering the reaction chamber through small tangential openings in the sides. In this way the air passes spirally up the chamber, and an arc, some 20 ft. long, is driven up in the centre of the rapidly-moving current of air.

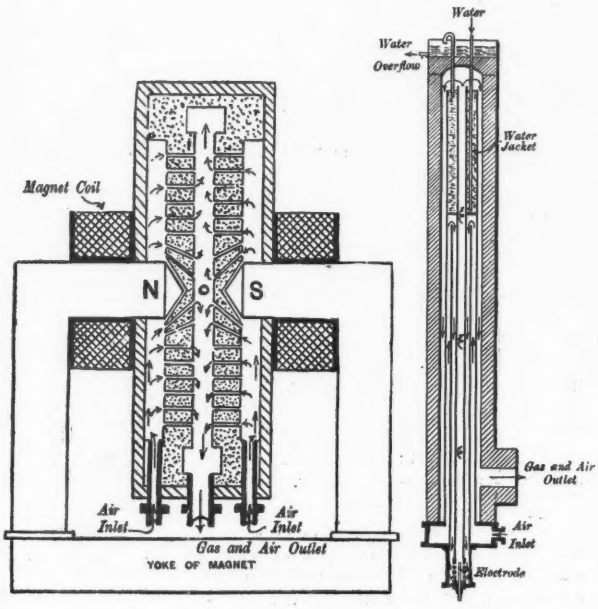
To obtain efficient operation, it is important to secure rapid cooling of the gases, and the upper portion of the tube is therefore water-jacketed. In this way dissociation is largely prevented.

The reaction is identical with that obtained in the Birkeland-Eyde furnace, and the efficiency is, to judge from the results obtained up to the present, practically the same. At Rjukan I there are now installed 96 Schönherr-Hessberger furnaces, each of 1,000 KW.

Before turning to the further processes involved, it may be mentioned that the air for the furnaces is delivered by large fans (shown on page 62) through iron pipes, and after being decomposed in the furnaces the nitrous gases formed, which have a temperature of 1,000° C, are passed under boilers, producing steam which is employed for the subsequent treatment of the products.

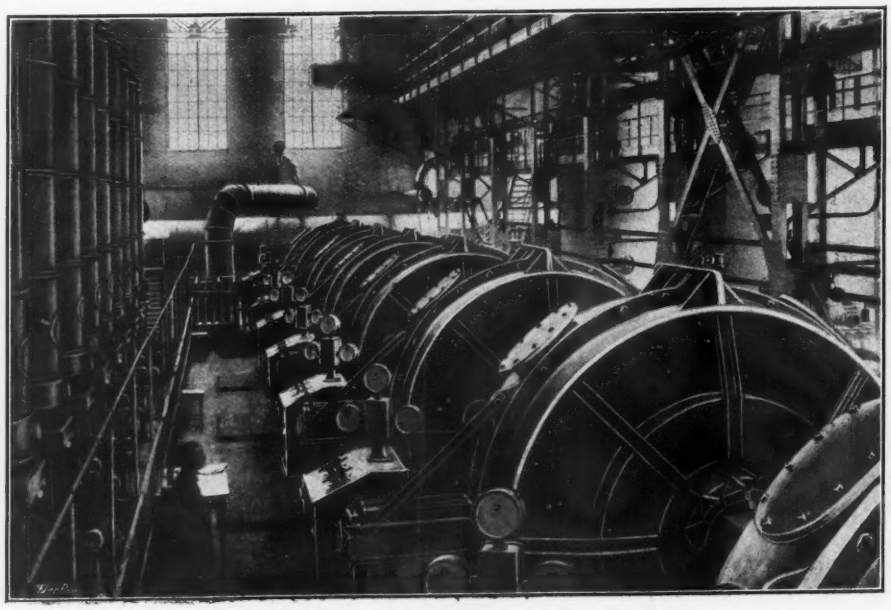
The steam boilers are shown on page 61, as also another view in the boiler house, with the air compressors, which supply compressed air for the pumping of acid and lye in the various departments.

From the steam boilers the gases pass through iron pipes to the cooling-house, where the remaining heat is extracted; the process consists in passing the gas through numerous aluminium tubes, which are cooled by running water. The gas is subsequently led to oxidation tanks, consisting of vertical iron cylinders, lined with acid-proof stone. The object in view is to give the cooled gases sufficient time for repose so as to allow for the oxidation



Sectional Views of the Birkeland-Eyde (Left) and Schönherr-Hessberger (Right) Furnaces.

to take place, the oxygen being present in sufficient quantities in the air which accompanies the gases from the furnaces. From the oxidation tanks the gases are conducted with the aid of fans to absorption towers, constructed of granite. There are 32 of these towers, each

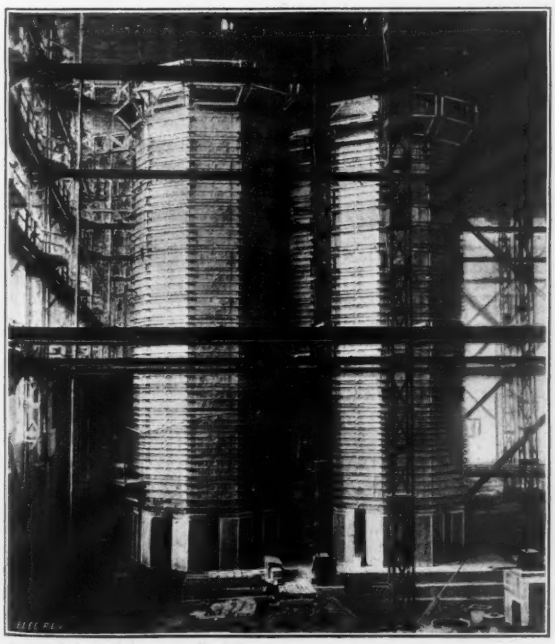


The Birkeland-Eyde Furnaces, Saaheim.

measuring 23 m. high and 7·2 m. in diameter, filled with broken quartz, which is chemically unaffected by nitrous gases and nitric acid; each row of towers is provided with centrifugal aluminium fans to assist the passage of the gases from the furnaces. The gases pass up and down alternative towers through the whole series, meeting water which trickles through the broken stone and combining with this water to form a weak solution of nitric acid. The gases are passed through a further 17 iron towers, in which a solution of nitrate of soda is produced. The absorbing liquid enters the top of the towers, and is distributed in jets by a series of earthenware pipes, so that the gases are brought into intimate contact with the absorbing liquid.

The acid solution flows to a granite cistern and is pumped to an elevated tank, from which it flows through the towers again until it attains the necessary degree of strength. Apart from the percolation system, the process in the iron towers is practically the same as that in the granite towers. Owing to its far greater power of absorption, the soda solution removes the last remaining traces of nitrogenous gases, about 97 per cent. being absorbed by the passage through the whole system. The finished nitric acid from the granite towers has a strength of about 30 per cent. by volume, and is collected in granite cisterns pending its use in the so-called dissolution works. In the latter are granite vats filled with limestone, over which the acid is poured, carbonic acid being liberated with violent effervescence, while the nitric acid takes its place, combining with the limestone and forming a watery solution of nitrate of lime or calcium nitrate. Any excess acid is neutralised in small towers filled with milk of lime, and the solution is then pumped into vacuum evaporating apparatus, the steam required for the evaporation being obtained from the steam boilers previously mentioned.

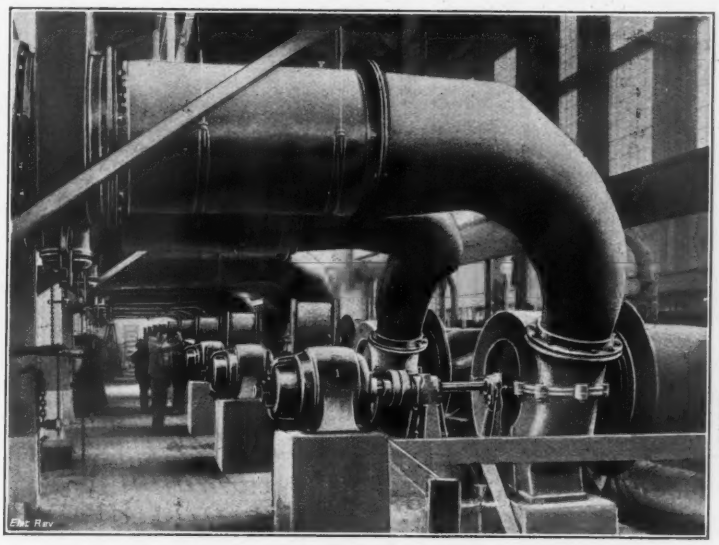
The concentration of the nitrate solution in the evaporating plant is continued until the specific weight of the



The Absorption Towers.

liquid at an even temperature shows a content of 13 per cent. of nitrogen; the solution is then pumped up into the solidification chambers, where it is passed over an internally cooled revolving cylinder and rapidly crystallises, being subsequently crushed to a granular state. The coarse powder produced is filled into casks, holding 100 kg. net weight.

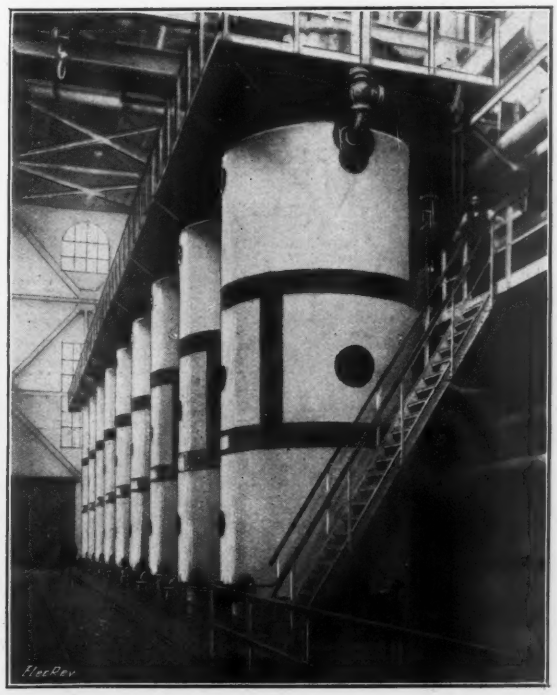
The gas in the iron towers combines with the solution of



Air Compressors Delivering Air for Pumping Purposes.

caustic soda forming nearly pure sodium nitrate, which is subsequently evaporated, allowed to crystallise and dried in a centrifugal, and filled into paper-lined moisture-proof casks.

The coopers' shop at Saaheim is a huge establishment,



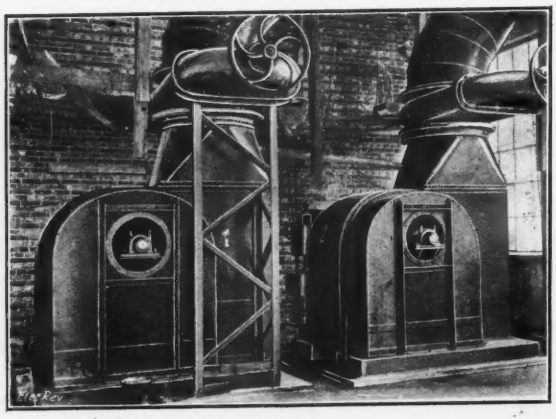
Steam Boilers Heated by Gases from Furnaces.

and one may get some idea of its size from the fact that about 3,000 casks and barrels a day are made. The furnace house covers an area of 6,000 sq. metres, the boiler-house 1,000 sq. metres, the tower house 7,000 sq. meters, and the barrel factory 2,500 sq. metres.

A visit to the Saaheim factories is very impressive; their huge size and the quietness which seems to rule everywhere, except in the packing departments and the barrel factory, are very striking. The whole process is worked automatically, and one might easily form a first impression that the establishment was on a holiday.

ELECTRICITY SUPPLY AT MILFORD-ON-SEA.

WE have in recent years repeatedly drawn attention to the possibilities offered by the supply of electricity in small towns and villages, more especially since the introduction of



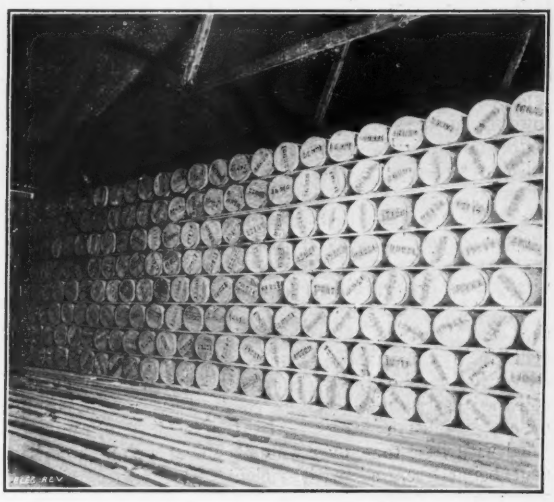
FANS SUPPLYING AIR TO ELECTRIC FURNACES, RJUKAN NITRATE WORKS (page 60).

the tungsten lamp has so greatly improved the competitive position of the electric light. For all such places we have advocated the use of overhead mains as the only means by which the supply can be given on a commercially satisfactory basis, and there is no doubt that the prejudice against aerial wires, for which there is little justification, is rapidly diminishing, many local authorities having adopted the system or assented to its adoption. But that it is possible to carry out a small undertaking and run it at a profit, even when the mains are laid underground, was recently brought home to us by a visit to Milford-on-Sea, a village on the Hampshire coast, where a supply of electricity has been provided by a small local company for the past nine years.

The proposal to commence the supply originated with Mr. L. Nicholson, one of the proprietors of the Milford-on-Sea steam laundry, who conceived the idea of running the plant in conjunction with the laundry, and discussed the matter with other residents. The advice of Messrs. Christy Bros. and Middleton was obtained, and a company was formed with a capital of £6,000; a provisional order was applied for and duly granted, and operations were commenced in 1903.

The plant consists of two Crossley suction-gas engines and producers, the former driving by ropes two Siemens dynamos of 24 KW. each, which generate direct current at 460 volts, for distribution on the three-wire system at 230 volts. A storage battery of 240 ampere-hours capacity was obtained from Messrs. Pritchetts & Gold, who maintain it in good condition under contract. The plant is housed in a building close to the laundry, which forms a good customer, as will be shown later. Although the producers were amongst the earliest made by Messrs. Crossley Bros., they have been in continuous operation for nearly 10 years with very successful results, giving very little trouble and costing little for repairs. One man is capable of running the whole installation, the battery being used to maintain the supply during the night and at other times of light load.

The mains consisted of vulcanised bitumen insulated cables laid solid in bitumen; more recently paper-insulated lead-covered and armoured cables laid direct in the earth have been employed. In some parts of the district the cables are below the water level, the land being water-logged, and some trouble has been experienced in this region; for this reason feeder pillars have been employed instead of ordinary disconnecting boxes.



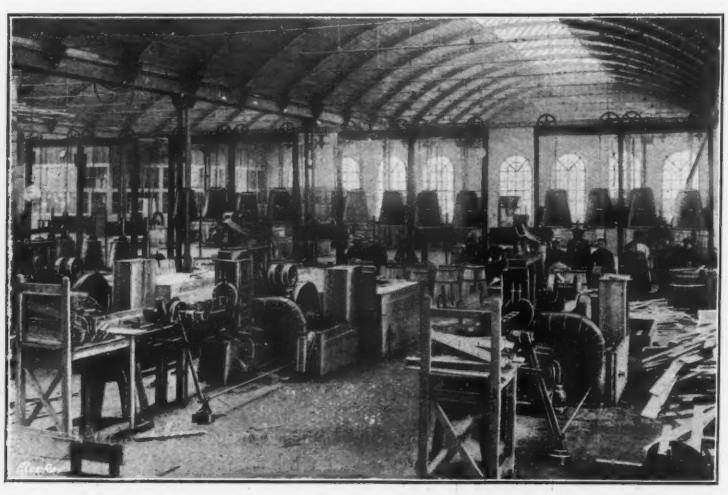
VIEW IN THE SAAHEIM BARREL STORES (page 61).

The streets are well lighted with tungsten lamps in simple fittings, usually of 50 C.P., but of greater power at important points. The effect is very good, and marks the little town as very much up to date, few places of the same size being so well illuminated.

The load is mainly lighting, in shops and private houses, as there are no industries in the district except that of agriculture. The laundry, however, forms an exception, most of its machinery being driven by a 7½-H.P. motor; electrically-heated irons and other appliances are also used, the total consumption per annum being some 55,000 units. There is also a builder and contractor at Keyhaven who takes power from the mains.

Hitherto it has not been possible to secure the farmers as power consumers, owing to the convenience and economy of petrol portable engines, which offer very keen and successful competition to the electric motor. Their distance from the mains is also an obstacle to the use of electricity. But progress in this direction is not despaired of; the electric motor is very portable and easily handled on the farm, as we have shown on various occasions, and if some enterprising agriculturist can be induced to lead the way, it is quite likely that others will readily follow the example.

The requests of outlying residents for connection are naturally somewhat embarrassing, as the cost of an underground cable swallows up most of the profits; such cases can only be dealt with commercially by using overhead wires, at least in the outer areas of the district, and there ought to be no objection to this course. It cannot be reasonably alleged that the landscape would be disfigured by them, for,



THE BARREL FACTORY, SAAHEIM (page 61).

in most cases, they would be hidden by the trees which grow so luxuriantly in this neighbourhood, and telephone wires are already met with in all parts of the district. The suggestion that any danger to the person would result is absurd, in view of the hundreds of miles of 500-volt trolley wires which are suspended over the most densely populated streets in our big cities, and of the numerous instances in which overhead conductors have already been adopted in this country—abroad, of course, they are the rule and not the exception in all small towns.

The crucial test of the success of the undertaking is the question whether it has proved worth while. The capital expended by the company so far has amounted to £7,200, and the dividend during the past few years has been practically 5 per cent. Remembering that the installation was carried out in the days of carbon lamps, and therefore with much more copper in the mains than would nowadays be necessary; that the mains without exception are underground; and that the supply is entirely by meter, this result must be regarded as very satisfactory. During the year 1912 the revenue amounted to £906, an increase of nearly £100, and a profit of £353 was made, of which £290 was available for distribution. The total number of lamps connected was 4,297, an increase of 150, and the amount of energy consumed was 55,192 units, an increase of 3,228. The price of energy was 6d. per unit, apart from contracts and public lighting, and the cost of generation and distribution was 2·4d. per unit.

The plant is in good condition, and appears to have many years of useful life before it; and there are many houses still, it is hoped, to be connected to the mains. There is no gas supply in the district. The prospects of continued success, therefore, appear to be very good, and we trust that they will be fully realised.

REVIEWS.

Dynamo Lighting for Motor-Cars. By M. A. Codd. London: E. & F. N. Spon, Ltd. Price 2s. 6d. net.

In view of the increasing vogue of electric lighting as the means of illumination on motor-cars, it is not surprising to find that handbooks on the subject are beginning to make their appearance. Mr. Codd, who has already published a work on Electrical Ignition for Internal-Combustion Engines, does not preface his new book with any remarks as to its purpose, but we should judge it to be intended mainly for the drivers of cars that are fitted with electric lighting equipments, so that they may be in a position, not only to keep the same in good running condition, but also quickly to diagnose the trouble, should any interruption take place in the regular functioning of any part of the outfit. The use of the book is, however, not limited to this purpose, for a perusal of the preliminary chapter would also be of advantage to any car owner contemplating the adoption of one or other of the many different dynamo car electric lighting systems, as he would then be in a better position to appreciate the respective merits of the various arrangements available for his choice and selection. At the same time, the utility of this section is somewhat curtailed by its brevity, the remarks relating to the choice of bulbs, in particular, requiring expansion, if they are to be of real assistance.

The second chapter relates to fitting the dynamo, and will be of use when such devices are to be fitted to existing cars. No doubt, when the author penned the lines to the effect that "most car manufacturers do not provide suitable provision for fitting the dynamo," the remark was perfectly true. Now, however, that particulars of the 1914 models are available, the statement does not apply to the same extent, as in a large number of cars a dynamo for lighting purposes is now being included as a standard portion of the equipment, due provision being made for the installation and driving of the dynamo in designing the petrol motor. The author draws attention to the effect of gearing on the output of the generator, amd his views on this subject, especially with regard to gearing in relation to the use to which the car will be mainly put—town work or touring—are worthy of careful study by all interested in furthering the employment of electricity for lighting purposes on automobiles. Although we notice Mr. Codd does not express any views as to the respective merits of the 6 and 12-volt lighting systems, he shows a preference for the single-insulated, or earth return, system of wiring over the double-insulated method. A good deal of the success, or otherwise, of an electric lighting system on a motor-car depends on the care taken with the wiring, and his suggestions in this connection are well worth following.

Six of the subsequent chapters are devoted to a description, with illustrations, of about fourteen of the principal dynamo systems at present on the market. Although not perhaps the author's fault, it would have been better if the blocks could have been better arranged, for it is somewhat fogging to lay readers to find an illustration of one dynamo interposed amidst the descriptive matter of another machine. This section, too, will probably need early extension, for there are now quite as many systems on the market in this country that are not included as are described, and, although it is not to be expected that any work should include particulars of every machine offered for sale, yet a would-be purchaser of the book naturally, first of all, looks to see if it deals with the particular machine in which he is interested or which he has to take care of.

On the whole, however, Mr. Codd's book should serve a useful purpose, for it will give both chauffeurs and motor repairers an insight into the principles underlying dynamo electric lighting on cars, and put them in a position to deal promptly with any derangements or interruptions in the working which may, from one cause or another, arise.

Formulæ and Tables for the Calculation of Alternating-Current Problems. By Louis Cohen. London: Hill Publishing Co. Price 12s. 6d. net.

Those who are already familiar with Mr. Louis Cohen's work on the capacity and inductance of electric conductors, and with his contributions to the *Bulletin* of the Bureau of Standards, will realise how exceptionally well qualified he is to undertake the laborious task of collecting together those mathematical formulæ and tables published by many independent workers, which are of practical importance in the solution of alternating-current problems.

Except that extracts from the author's earlier work are necessarily numerous in a field where this work must occupy an important place, Mr. Cohen modestly lays no claim to original authorship in the present volume, but is content to let it appear that he is mainly a compiler of the useful formulæ of other writers for handy reference.

The reader who has had experience in first seeking and then unravelling the mathematical investigations which bear on any particular problem with which he may have been faced, will realise that the unpretentious title of "compiler" may, in the present case, represent qualities of originality, insight and judgment—to say nothing of patience—higher than those displayed by the "authors" of many scientific works of greater pretension.

The formulæ are introduced with just that minimum of explanation which is necessary to enable an intelligent use to be made of them. References to the original sources from which they are derived, and indications as to the limits of error involved, are freely given.

The simplification of the formulæ, and their conversion into a reasonably uniform system of symbols, must have in itself involved much painstaking labour. Numerous tables are added to minimise numerical calculation when the formulæ are of an involved character.

The first chapter deals with the resistance of, and losses in, metallic conductors. The range of materials and of forms of conductors, their varying situations and the variety of problems due to low-frequency and very high-frequency alternations, lead to a large number of formulæ, covering ground which belongs to widely separated branches of electrical engineering.

The second chapter, dealing with inductance, is one of

special value, on account of the very clear summary which it affords of a subject of the highest practical importance in almost all branches of modern electrical engineering. This is followed by a chapter on the capacity of conductors.

Then follows a very useful series of formulæ concerned with the alternating-current circuit, in which complex waves, various combinations of inductance and capacity, transformers for voltage and current transformation, and similar problems, are considered. In this chapter full use is made of the usual symbolic notation.

This is followed by two chapters dealing with transient phenomena and distributed inductance and capacity, and by a final chapter containing general mathematical formulæ and tables of functions, &c.

Although the book is essentially a compilation of formulæ of practical use for reference, it is really more than this. It forms a highly concentrated summary of the theory of the transmission of alternating currents prepared in such a way that it is adapted at every step for direct application to practical numerical calculation.

To the busy designer who is faced with constantly new problems, the book will prove of the highest value, while the electrical profession, as a whole, will be the richer for a book of reference which can be consulted with advantage in connection with nearly all technical problems involving the theory of alternating-current conduction.

In conclusion, we may commend Mr. Cohen's work to the attention of those who are responsible for the training of the young generation of future electrical engineers. They will find here an excellent summary of the type of mathematical calculations which the advanced student should be able to carry out, and may thus gain valuable insight into the direction along which his mathematical training should be conducted.

Researches in Magneto-Optics (with special reference to the Magnetic Resolution of Spectrum Lines). By P. Zeeman, D.Sc. 1913. London: Macmillan & Co. Price 6s. net.

Macmillan's Science Monographs now occupy an important place in our scientific literature, and this recent addition undoubtedly enriches the series.

Prof. Zeeman is, of course, *the* authority on magneto-optics, for he has spent his career in that realm of physics where magnetism and light appear to meet, and to him are due, in a large measure, not only our experimental knowledge of that borderland, but also many very beautiful theoretical suggestions upon which other fruitful researches have been based.

In dedicating his volume to the memory of Michael Faraday, Prof. Zeeman has, as he remarks in his preface, honoured "the greatest experimental genius the world has produced, and the pioneer in magneto-optics, as in so many things," and it is interesting to note that it was upon this very subject that Faraday was engaged at the time of his death. It is indeed fortunate that the cloak of the pioneer has fallen upon so capable an experimenter as Dr. Zeeman, and that after the lapse of nearly half a century this fascinating subject is receiving the attention it deserves.

This volume follows on the lines of a lecture delivered by Dr. Zeeman to the Royal Institution in 1906, the material having been expanded and more recent researches added. Although a more extensive exposition of the author's own investigations is given, the whole field of magneto-optics is systematically and completely surveyed, and many of the intricate theories connected with Series Spectra are dealt with in detail. The familiarity with which Dr. Zeeman treats of so large and difficult a field of research excites in us something of wonder and admiration, and the multitude of references to work done by other experimenters strengthens the conviction that the author has not only added largely to our knowledge of magneto-optics by his own research, but also has made himself so thoroughly conversant with all the work that has been done on the subject that he is able to view magneto-optics in the true perspective, which is so often lacking in the works of original investigators.

The earlier chapters deal with the "Zeeman Effect" in its well-known forms—the splitting-up of spectrum lines into doublets and triplets in the magnetic field and the magnetic resolution of absorption lines. More complex resolution is then treated of, and the relations existing between the resolution of lines belonging to the same series.

A chapter is devoted to solar magneto-optics, and the final chapter deals with the contributions made by magneto-optical researches to our knowledge of the constitution of the atom. A chronologically arranged bibliography containing references to over five hundred papers on the subject adds considerably to the usefulness of the book.

To appreciate the book fully, the reader must have studied physical optics and spectroscopy fairly completely, and although the first chapter is devoted to an illustrated account of the chief spectroscopic instruments, it is not until one has handled such apparatus and attempted the photography of spectra for oneself that the magnificence of the work done by Zeeman and his co-workers becomes apparent. To obtain the faintest trace of magnetic resolution requires expensive apparatus both in the form of gratings and electromagnets; Zeeman's experiments required, in addition, that touch of genius which has, in the first instance, given to the world the "Zeeman Effect," and more recently has given us this delightful monograph on magneto-optics.—P.H.S.K.

Electricity in the Service of Man. Vol. II, Sec. I. By R. M. Walmsley, D.Sc. London: Cassell & Co. Price 7s. 6d. net.

This book is the first part of the second volume of a "popular and practical treatise on the applications of electricity to modern life." The word "popular" applies only from the fact that the book is not an elaborate mathematical exposition of the principles of electrical engineering, since the volume certainly does not conform to the usual meaning of "popular" as ordinarily understood. It is really far too good to be classed with the somewhat vague and diffuse type of literature known as "popular."

Chapter I deals with continuous-current dynamos, and the treatment is essentially modern. Ancient history is rightly cut down to the absolute minimum, and good illustrations and descriptions of turbo-dynamos and engine-driven machines of recent make by well-known manufacturers are included. The magnetic circuit of D.C. machines is treated at length, good use being made of the Hele-Shaw water-flow diagrams. Armature winding schemes are discussed from an essentially practical point of view, and the reproductions of photographs of actual former-wound coils will undoubtedly be found useful to many students. It is interesting to note that homopolar machines receive a very fair amount of attention, their special points being well put forward. The mechanical construction of many different types of modern machines, *e.g.*, brush gear, armatures, commutators, and bearings for turbo-dynamos are clearly described with the aid of line diagrams and photographic reproductions. The regulation of D.C. machines is next considered, and the construction of a considerable number of field rheostats, including the special Thury brush-shifting device, is carefully analysed. Immediately following we find a number of output-coefficient curves and output formulæ, together with the effects of current and voltage in limiting and modifying these semi-empirical results. This chapter concludes with the discussion of a number of typical and special machines.

Chapter II is devoted to alternators. Practically every type of alternator that is now made is described in considerable detail, *e.g.*, the enormous low-speed, water-wheel driven machines manufactured in America are discussed in a highly satisfactory manner, while turbo-alternators by all the leading English and foreign manufacturers receive the same attention. A short outline of the elementary theory of the alternator is given, and a good deal of information regarding characteristics, the production of harmonics, excitation and regulation is included.

The third chapter, consisting of 150 pages, deals with generating stations, and these important features of modern civilization are described at considerable length. The author, after an introduction, commences with the descriptions of ancillary and special electric supply stations, including the stations recently put down at Immingham

Docks, and the General Post Office, London. The running of D.C. and A.C. generators in parallel, synchroscopes, "hunting" and so on, are next discussed, and the treatment is quite simple and satisfactory. Public supply stations are then considered, and a large number of typical load curves are given. The governing principles of steam, gas, oil and water-driven stations are next examined, and are exemplified by plans and photographs of existing power stations in various parts of the world. Switchgear and switching are treated in detail in the fifth section of this chapter, the illustrations and treatment being quite up to date.

The concluding chapter discusses the lengthy subject of continuous-current motors, their regulators and starters. The treatment is very largely descriptive, and this is quite in order, since the design of continuous-current generators has been fully dealt with in Chapter I. Some space is, however, wasted by including plates and descriptions of motors that are now obsolete.

As a whole, the book is decidedly good, but it would have been better, considering its character, had some idea of costs and prices been given, for some of the plant and apparatus described.

There are 686 pages, and 691 illustrations, including 11 plates, in the volume; it is well bound and printed, and it will be seen from the above review that the book is distinctly cheap. It will, doubtless, be largely used by students and teachers who wish to keep up to date.—H. G. S.

Telephone Erection and Maintenance. A handbook for the contractor and wireman. By HERBERT G. WHITE. London: S. Rentell & Co., Ltd. 1913. Price 1s. 6d. net.

Although there exists at present a large number of books on the more important phases of telephone engineering, that portion of the profession which is concerned with domestic and other private installations has hitherto received but scant notice in technical literature.

The present book has been written to fill this gap. No attempt has been made to deal with the details of construction or the theory of action of telephone apparatus, but the various systems which have been devised to meet the special requirements of the private user are described in considerable detail. The ground covered includes telephones fitted to electric bell systems, battery and magneto call telephones, ordinary and secret intercommunication telephones, mining telephones, and the simpler switchboard systems. The last two chapters deal with instrument erection and line construction, and with the testing of apparatus and the localisation of faults.

The book is well illustrated, and the diagrams are very clear. It should be found of great use to all those who are engaged in the special work with which it deals.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued:—

Monday, January 12th.—"A" Company. Technical instruction, 7 p.m. to 10 p.m.

Tuesday, January 13th.—"B" Company. Ditto.

Wednesday, January 14th.—Recruits only. Infantry drill and technical instruction, 7 p.m. to 10 p.m.

Thursday, January 15th.—"C" Company. Technical instruction, 7 p.m. to 10 p.m.

Friday, January 16th.—"D" Company. Special class on Crossley engine and technical instruction, 7 to 9.30 p.m.

Saturday, January 17th.—Headquarters will be opened for regimental business only from 10 a.m. till 12 noon.

(Signed) F. R. HOLT-WHITE, Capt. R.E., Adjutant.
For Officer commanding L.E.E.

Inquiries.—Makers of the C. Beyer electric hair-drying fan are asked for; also names of makers of the Le Radiant radiator lamp, and the Saunders lamp-locking device

FORTHCOMING EVENTS.

Greenock Electrical Society.—Friday, January 9th. At 7.45 p.m. A Temperance Institute, West Stewart Street. Papers on "Thoughts on Cable Chemistry," by Mr. Lowrie Sinclair, and "Cable Faults and their Causes," by Mr. L. Hogg.

Junior Institution of Engineers.—Friday, January 9th. At 8 p.m. At 39, Victoria Street. Paper on "The Future of the Institution," by Mr. C. H. Woodfield.
Saturday, January 10th. Visit Works in progress at London Docks for the Port of London Authority.

Manchester Association of Engineers.—Saturday, January 10th. At Grand Hotel, Aytoun Street, Manchester. Paper on "Transmission of Power by Chains," by Mr. H. T. Hildage.

Institution of Post Office Electrical Engineers.—Monday, January 12th. At 6 p.m. At Institution of Electrical Engineers, Victoria Embankment. Paper on "The Loading of Aerial Lines and the Electrical Constants of Loaded Circuits," by Mr. J. G. Hill.

Institution of Mechanical Engineers (Graduates' Association).—Monday January 12th. At 8 p.m. At Storey's Gate, S.W. Paper on "The Arrangement of Modern Engineering Shops," by Mr. H. C. Armitage.
Friday, January 16th. At 8 p.m. Paper on "Commercial Tests o Internal-Combustion Engines," by Mr. W. A. Tookey. Nominations for Annual Election of Officers.

Institution of Civil Engineers.—Tuesday, January 13th. At 8 p.m. A Great George Street, Westminster, S.W. Paper on "Superheating Steam in Locomotives," by Mr. H. Fowler.
(Students' Meeting).—Friday, January 9th. At 8 p.m. Paper on "The Application of Power Railway-Signalling in Great Britain," by Mr. C. I. Routh.
Wednesday, January 14th. (Students.) Visit Queen's Park Extension, Baker Street and Waterloo Railway.

Institution of Electrical Engineers (Manchester Local Section).—Tuesday, January 13th. At 7.30 p.m. At the University (Physical Lab.) Paper on "British Practice in the Construction of High-tension Overhead Transmission Lines," by Mr. B. Welbourn.

Institution of Electrical Engineers (Scottish Local Section).—Tuesday, January 13th. At 8 p.m. At 207, Bath Street, Glasgow. Paper on "The Employment of Power in H.M. Post Office," by Mr. H. C. Gunton.

Nottingham Society of Engineers.—Wednesday, January 14th. At Welbeck Hotel, Milton Street. Paper on "Brush-Ljungstrom Steam Turbine," by Mr. Lloyd Evans.

Royal Society of Arts.—Wednesday, January 14th. At 5 p.m. At John Street, Adelphi. Juvenile Lecture on "Electric Vibrations and Wireless Telegraphy," by Mr. R. P. Howgrave-Graham.

Association of Engineers-in-Charge.—Wednesday, January 14th. At 8 p.m. At St. Brice Institute. Paper on "Commercial Motors, Steam and Petrol," by Mr. D. J. Smith.

Institution of Electrical Engineers (Yorkshire Local Section).—Wednesday, January 14th. At 7 p.m. At the Philosophical Hall Leeds. Ordinary general meeting.

Illuminating Engineering Society.—Thursday, January 15th. At 8 p.m. At the House of the Royal Society of Arts, 18, John Street, Adelphi. Discussion on Mr. P. J. Waldram's paper "Some Problems in Daylight Illumination, with special reference to School Planning."

NOTES.

Fatalities.—An inquest was held at Coventry on January 1st into the death of George Oliver Randle, assistant electrician at Exhall colliery. Evidence showed that he was splicing a cable when, through some mistake, the current was turned on and he received a shock which proved fatal, despite artificial respiration and medical attention. Mr. William Foster, chief electrician, said he had nine assistants, all of whom, except deceased, had received their certificates, and he would have done so in time. The current used was 300 KW. at 580 volts. There were more than 30 motors underground, varying from seven to 100 H.P. On the night of the accident deceased was moving a cable forward to the coal face in connection with a pump, and, of course, the cable should be dead. The switch was about 320 yards away, and when the current was turned off it was customary for a boy to unscrew the handle and leave it in charge of the man doing the repairs. When witness examined the circuit-breaker soon after the accident he found the handle was on, whereas he expected to find it off. Edward Ford, motor boy, said he was warned not to put the current on until it was rung for. For this the signal was nine, a pause, and then 20. He was away at another motor when he heard some ringing. He went back and rang six, meaning an inquiry as to what was wanted. The signal came back 20, and he switched the current on, having forgotten for the moment it should have been preceded by nine. He did not realise that he had done anything wrong until two or three minutes later, when a signal came to switch the current off again. It then occurred to him he had not received the nine, and that he might have caused an accident. Oliver Orton, chief underground electrician, said it was the custom amongst electricians to take the handle off the switch when repairing the cable, but he could not say it was always done, though he always did so himself. Deceased ought to have seen for himself that the handle was removed before repairing the cable. George Hart, motor boy, gave evidence as to sending the signal from his motor for the current to be turned on, and said he was not aware a cable was being repaired. The jury having found that Randle died from electric shock accidentally received, expressed the opinion that the motor boys, Ford and Hart, had not been properly instructed and were not proper persons to leave in charge of such an important switch; the jury also suggested that instructions be given to the electrician to take the handle off the switch in every case when repairs were being carried out.

Our Cape Town correspondent states that H. E. Haworth, a Dundee electrician, was killed on December 12th at the Natal Steam Co.'s mine, Dundee, Natal, where he was engaged in connection with the erection of an electric coal-cutter. Haworth and a native were working together, and it is understood that some heavy timbers fell on them, killing them instantaneously.

D. Heydenrich, who was working on the railless trolley installation at Boksburg, died on December 18th as the result of an accident. Whilst engaged in fixing an overhead wire at the subway on the main road to Boksburg North, he was standing on a long ladder which projected some distance above the parapet of the railway bridge. The top of the ladder slightly overhung the railway line, and a train, in passing, caught the ladder and hurled it aside; Mr. Heydenrich fell to the ground, terribly fracturing the base of his skull, and died on his admission to hospital.

According to the *Manchester Courier*, one man was killed, two were seriously injured, and ten others received minor injuries on Monday by the bursting of a 3-ton fly-wheel of a motor-generator set in the "D" aisle of the testing department at the Trafford Park Works of the British Westinghouse Co.

German Trade and the American Tariff.—On the influence of the new American Customs tariff on the German electrical industry, the *Münchenes-Nachrichten* has the following. On October 3rd President Wilson signed the Underwood Bill, which abrogated the Payne-Aldrich tariff, and inaugurated, in whole or in part, the abandonment of the former high tariff policy. The reductions effected by the Underwood Bill in the tariff previously in force amount, on an average, to 20 per cent. Connected with these proceedings the question arises whether German industry, and more especially the electrical industry, is better able to compete under the new than the old tariff. It may be assumed that the export of German electrical products to the United States must now increase, as the tariff reductions of the Underwood Bill are not inconsiderable. While the average old tariff on electrical products amounted to 40 per cent., the average of the new totals only 28 per cent. This means an average reduction in duties of 12 per cent. When, however, it is remembered that German exports have to bear considerable railway charges to the port of shipment, sea freight, sea insurance and Consular charges, it will be seen that the reduced 28 per cent. tariff really amounts to a prohibitive duty. The American electrical industry may, indeed, always reckon upon being able to sell to home consumers at 30 per cent. less cost than the German competing industry. A striking case in point is furnished by lamp carbons, which have been radically affected by the tariff changes. Hitherto they have been charged duty on the number basis, now the duty is reckoned by value. The apparent duty reduction in consequence works out to a remarkable tariff enhancement, and will be further increased by the projected German taxes on lighting materials. Thus, arc lamp carbons, which have hitherto formed the largest item of export to the United States, undergo the enormous increase represented by the difference between 5·97 per cent. (by the old tariff) and 45 per cent. of the invoice value (by the new tariff). In this way, the competition of the German carbon industry on the American market is as good as annihilated. The electrotechnical export trade between the United States and Germany in the last five years progressed as under:—

	Germany to U.S. (in 1,000 marks).	U.S. to Germany.
1908	1,259	441
1909	1,554	446
1910	1,554	527
1911	1,550	726
1912	2,328	682

This means that in the years 1909 to 1911 the German electrotechnical industry barely held its American goods outlet; but from 1910 to 1912 German exports rose from 1,500,000 to 2,300,000, or about 50 per cent., apart from the considerable exports of carbons. The small United States exports to Germany of under a quarter of a million in the same period may be left out of account. Ground has been won in the American market, in the first place, by carbons, then by glow-lamps, telegraph and telephone apparatus, galvanic cells, medical apparatus and reflectors. Although the totals may not be very large, they are yet evidence of the steady German progress. But for the chief export article, dynamo machines, the duty of 20 per cent. is still prohibitive, as also before and since for other electrical products. To the high tariff is added the hindrance to the import trade produced by the rigorous carrying out of the regulations of the Customs Department by the American Customs officials. The electrotechnical industry of the United States may be strong enough to ensure a continuance of such a rigorous enforcement of the Customs regulations, in which case, notwithstanding the lessened tariff burdens, the German electrotechnical industry can hardly hope for any essential progress in the American market in the future.

A Peculiar Lightning Stroke.—Our Norwegian correspondent informs us that during a recent thunderstorm in Norway a chimney of a factory in the country was struck by lightning. The height of the chimney was 39 m., and it was furnished with a receiving rod of a length of 2·5 m., which was connected with a copper cable having a cross section of 40 sq. mm. The cable was fixed to the chimney by means of staples, at intervals of 1·5 m. from each other. The earth-plate resistance was 4 ohms. When the chimney was struck, the rod was not damaged, whereas the cable was, and also the brickwork on the top of the chimney. The lightning did not pass in the ordinary course into the earth through the plate, but jumped over to the roof of a brick house, which was covered with zinc plates. The distance between the house and the chimney was 9 m., and the lightning followed the zinc roof over a distance of 11 m. to a zinc pipe, which served as conductor for another 9 m. At a distance of about 1·6 m. from the earth the lightning left the zinc pipe and passed through the brick wall of the house, which had a thickness equal to the length of two bricks. On the inner side of this wall were some copper rings, which were partly melted, and the lightning then disappeared in the iron skeleton of the building, which was connected with a steam pipe. The water and gas pipes were laid quite near the iron construction, but neither of them showed any traces of having been struck. Measurements were afterwards made, by which it was established that, apart from the resistance of the earth-plate to earth (4 ohms) the iron construction had a resistance of 26 ohms, the steam pipe 21 ohms, the water-pipes 2·1 ohms, and the gas-pipes 0·9 ohm. to earth.

Where the lightning had followed the zinc pipe, the parts of which were connected in the ordinary way by the end of one being put into the other, the interior ends of the pipe had been folded or curled together, while the exterior ends had either burst or been torn up. This may very likely have been caused by the sudden and enormous pressure of air, or possibly by the evaporation of water, which may have been present between the ends of the pipe.

It is very remarkable that the lightning, instead of passing to earth through the conductor which offered least resistance, jumped to the roof and followed a path where the resistance was considerably larger.

A further examination of the copper cable showed that in many places it must have been heated up to the melting point, or about 1,000° C. From this we may be able to get an idea about the strength of the current, provided that a certain time for the discharge is assumed. This may possibly have varied between 0·03 and 0·001 of a second. If now the specific heat of the copper is put at 0·12, and the specific resistance at 0·05, one will get as a result about 20,000 amperes on the basis of a discharging time of 0·03 second, and about 100,000 amperes on the basis of 0·001 second.

It is not often that there is an opportunity of following and tracing the path of lightning so closely as has been done in this case, and it may be regarded as beyond doubt that if many such observations were made, and it were possible to calculate the effect of lightning by means of figures, this might become of immense importance in showing the way towards mastering one of the most powerful and irresponsible forces of Nature, the electricity of the air.

Copper.—The end of the year finds stocks still holding up against numerical exhaustion. English stocks, as shown by Messrs. Merton's statistical circular, were reduced by 485 tons, while French increased by 705 during December. European supplies lost 480 tons, but, on the other hand, if Holland and Germany be included, there is a considerable gain of 2,763 tons, from which it may be inferred that the commercial countries are laying in what the others give out. Supplies from North America during the month were well up to the average quantity, from Spain the same; Chile shipments are high, Australian rather below the average. Total deliveries are still a reasonable figure (43,698), representing average business, higher than in the two preceding Decembers. American supplies during November increased by the noteworthy figure of 6,859 tons. In the face of this, the steadiness of the price is not astonishing. The world's supply at the end of November was 42,877 tons, an increase of 6,989 tons on the quantity for the end of October.

Educational Notes.—IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY; CITY AND GUILDS (ENGINEERING) COLLEGE.—Advanced Courses of Instruction will be given in the "Principles, Design and Manufacture of Electro-Magnetic Machinery and Transformers, (Including) The Organisation of Electrical Manufactories," by Dr. S. P. Smith; and in "Rotary Converters," by Prof. Miles Walker. Both courses commence in February. See our advertisement pages.

BATTERSEA POLYTECHNIC.—As already announced, a course of Advanced Lectures on Generating Stations, by Mr. W. H. Patchell, has been arranged for Mondays, from January 19th to February 16th. Free. Particulars are given in our advertisement pages.

Institution and Lecture Notes.—NOTTINGHAM SOCIETY OF ENGINEERS.—In the syllabus for the 1914 session, the following papers are announced:—January 14th, "Brush-Ljungstrom Steam Turbine," by Mr. Lloyd Evans; February 11th, "Defective Boiler Mountings," by Mr. F. W. Sisson; March 11th, "Utilisation of Exhaust Steam and the Approximate Cost of Producing Electrical Energy therefrom," by Mr. W. C. Mountain.

WIRELESS SOCIETY OF LONDON.—A meeting of this society will be held at the Institution of Electrical Engineers on January 21st at 8 p.m., when an address illustrated by experiments will be given by the President, Mr. A. A. Campbell Swinton.

At the meeting of the BIRMINGHAM LOCAL SECTION on Wednesday, a paper was read by Mr. B. Welbourn on "British Practice in the Construction of High-Tension Overhead Transmission Lines." The discussion was closed.

Appointments Vacant.—Engineer-in-charge for Darlington Corporation (£2); works engineer and shift engineer for Wednesbury Corporation electricity department; mains assistant for Rawtenstall Corporation (35s.). Particulars are given in our advertisement pages.

Electricity on British Warships.—Too late for inclusion in our "Correspondence" columns, the following letter has come to hand on the subject dealt with in one of our leaderettes to-day :—

(*Re* H.M.S. *Invincible.*)

"As one who has for many years tried to get shipowners to appreciate the many vast economies which are to be made by the use of electrical power both for main propulsion and for the driving of auxiliary machinery on ships, and knowing also the difficulties which a shipowner has to meet, in coming to the conclusion to use electric power, owing to statements made against it (for reasons best known to themselves) in the Press, and before the Institution of Naval Architects and other places, I view with alarm the published announcement in the *Pall Mall Gazette* on December 31st last, with regard to H.M.S. *Invincible* to the effect that after five years of devotion of money and time to perfect it, the electrical gun operating gear is to be now replaced with hydraulic. Considering that the experience of electrical gun operation is limited in this country, compared with the magnificant work done on foreign ships with electrical driving, and the fact that the new Russian ships are to be so fitted (with their recent actual practical 'war' experience), if the matter were not so serious for its ultimate effect on the Merchant Marine, this conclusion by British Admiralty officials would be the very height of early Victorian humour.

"I can quite understand the position ; I have no doubt that 'no hits' causes discontent amongst the gunnery men, and there is no love lost between the two competing departments of the Navy, *i.e.*, the torpedo and the gunnery departments. It seems so out of date and fossilised to allow, by red tape Whitehall officialism, the gunnery department's electrical power to come under the torpedo department. Yet when hydraulic power is put in, the whole lot comes under the officers and men of the gunnery department, an arrangement (not the only one) which is the laughing-stock of the naval officers of the European and American Continents, and for which the British people have to pay.

"What is to me so amusing is that a number of early Victorian officials and other things on half-pay (some in Parliament at £400 a year), who know more about dead-reckoning, tar-buckets or marline-spikes, are directing affairs, and even although they have not the slightest knowledge of even the fundamental features of modern electrical power engineering, they condemn or support anything new like 'bulls in china shops.'

"Considering that electrical driving has been found so satisfactory in other Navies, a list of which I give below, it will be seen that with proper design and application electric driving is a well-tried and successful feature of gun and turret operation on ships of war. As far as I have been able to ascertain from official records the following countries have secured the advantages and efficiency that are consequent upon its use :—

United States of America...	32 ships
" "	E.S. *Jupiter* (main propulsion)
Germany	30 ships
France	36 "
Austria	14 "
Russia	14 "
Japan	18 "
Italy	9 "
Greece	several "
Chile	" "
Brazil	" "
China	" "
Argentine	" "
Spain...	" "
Great Britain	4 "

"It will be noticed that progressive France tops the numbers, followed by the U.S.A., and Germany, countries to whom Great Britain can confidently look for acute competition both from a naval as well as a mercantile service point of view.

"Is the dignity of the profession of electrical power engineering to stand this? Are we going to sleep over it? or are we going to do the right thing now we have the chance, *i.e.*, make public protest?

"WILLIAM P. DURTNALL, M.I.MAR.E."

X-Rays and Cancer.—In a paper read before the Röntgen Society on Monday, Dr. Jean Clunet dealt with the "Histological Changes produced by X-rays on Animal Tissues," showing the effects produced respectively by strong and mild doses, and explaining the action of the rays in cases of cancer. The paper was regarded as a valuable addition to knowledge on the subject.

Electricity in Agriculture.—In the *Electrical World* of December 13th, Dr. H. G. Dorsey describes experiments made near Dayton, Ohio, to discover the effect of electricity and artificial illumination on the growth of plants. Plot No. 1 was excited with high-frequency currents from a small Tesla coil, wires being strung over the soil at a height of 15 in. The stimulation was applied for one hour morning and evening at 10,000 volts, and about 200,000 cycles per second. Plot No. 2 was illuminated with a 100-watt tungsten lamp with ruby bulb three hours a day. Plot No. 3 was similarly treated with a Cooper Hewitt mercury-vapour lamp, and Plot No. 4 was used as a control. Plot No. 5 was sprinkled with partly electrolysed water, and Nos. 6 and 7 were traversed by weak alternating and direct currents.

The plot subjected to high-frequency current showed a greater increase in yield than any of the others. Ruby light came second for radishes, and violet light second for lettuce. The sprinkling system proved worse than useless. Comparing the high-frequency plot with the control plot, the edible portion of lettuce grown was 75 per cent. greater than under natural conditions. Further experiments at the time were interrupted by the Dayton flood, but later on wires were erected over a field, 9 ft. high and 15 ft. apart, and were charged up to 50,000 volts for some hours daily. Owing to the delay in getting to work, only qualitative results were obtained, but these indicated a probable increase in weight of about 20 per cent. :—

RESULTS OF TESTS IN ELECTRIC STIMULATION OF VEGETABLES.

Radishes (10 plants selected at random):	Plot 1, Tesla.	Plot 2, ruby light.	Plot 3, mercury vapour.	Plot 4, control.	Plot 5, electric sprinkling.
Total plant weight, gm. ..	265·70	137·80	109·50	180·00	78 50
Edible portion, gm.	139·50	67·40	40·90	79 40	31·90
Tops and leaves, gm.	120·50	75·70	65·90	95 00	41 50
Roots, gm.	9·30	4·70	3·20	5 60	6·00
Lettuce (10 plants selected at random):					
Total plant weight, gm. ..	67·00	52·60	56·50	46·10	31·30
Edible portion, gm.	60·70	47·30	50·20	41 80	28 20
Roots, gm.	6·30	5·30	6·30	4·30	3·10

Throughout the article the author makes no reference to prior work, and the fact that he is repeating experiments carried out by Sir Oliver Lodge years ago appears to be unknown to him.

"The Electric House" at Birmingham.—The Electric Supply Publicity Committee are exhibiting "The Electric House" at Birmingham, from January 12th to 16th, the week of the Birmingham and Midland Institute Conversazione. This exhibit is substantially a replica of La Maison Electrique shown with such great success at the recent Ideal Home Exhibition. The Birmingham Corporation Electricity Department, which is interested in this exhibit, is to be congratulated upon its enterprise in adopting this means of popularising the uses of electricity. Birmingham is the first provincial City in which this particular exhibit will be shown. If the popular interest there is anything like that shown at Olympia, we imagine that the house will serve for many other centres too.

An Edison Engine Starter?—The last American mail brings the news that Mr. Thomas A. Edison is interesting himself in the subject of electric engine starters for petrol motor-cars, and that he is at work on a design which will be more an integral part of the car, and less an applied adjunct, than many of those at present on the market.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. F. L. PEDLEY, of Bingley, has been appointed chief engineer for the Bingley U.D.C. electricity sub-station.

The Derby T.C. has appointed MR. W. L. WEBB, as electricity showroom attendant.

Tramway Officials.—The Tramways Committee of the Salford Town Council has adopted the following recommendations of the Special Sub-Committee *re* traffic arrangements : (*a*) That the minimum salary of the traffic superintendent be fixed at £200 per annum, with two advances of £20 and one of £10 at intervals of two years, to a maximum of £250 per annum. (*b*) That MR. W. BLAKEMORE be promoted to the position of traffic superintendent as from January 1st, 1914. (*c*) That MR. C. F. ELLWOOD be promoted to the position of chief clerk of the traffic staff at a commencing salary of £140 per annum, with biennial increases of £15 to a maximum of £200 per annum. The appointment is also to date from January 1st. (*d*) That the salary of MR. W. BILLINGTON, chief clerk of the general staff, be increased from £170 to £190 per annum, with biennial advances of £20 to a maximum of £250 per annum, and that the minimum salary of future holders of this position be fixed at £169 per annum, with four advances of £20 and one of £10, at intervals of two years, to a maximum of £250 per annum. (*e*) That the salary of MR. H. RICHARDSON, permanent way superintendent, be increased from £200 to £220, with advances of £20 and £10 every two years to a maximum of £250 per annum. Minimum amount to future holders, £200, to a maximum of £250. (*f*) That the salary of MR. R. CHADWICK, car depôt superintendent, be increased from £180 to £195, with biennial advances of £15 and £10, to a maximum of £220 per annum. Minimum salary to future holders, £160, with biennial increases of £15 to £220. (*g*) That the salary of MR. H. WESTON, overhead equipment superintendent, be increased from £160 to £175 per annum, with biennial advances of £15 and £10, to a maximum of £200 per annum. Minimum salary to future holders, £160 to £200.

The Reading T.C. on January 1st decided to increase the salary of MR. G. F. CRAVEN, engineer and manager of the tramways undertaking, from £400 to £600 a year, by annual increments of £50. A motion that the salary be raised to £450 only was rejected by 29 votes to 4.

General.—MR. GUY CALTHROP has been appointed general manager of the L. and N.W. Railway.

Last week MR. S. A. BOUSTEAD, of Walkden, near Manchester, retired from the service of the Lancashire and Yorkshire Railway Co., as telegraphs inspector, after being in their service for 44 years. He was presented by his colleagues with a purse of gold and a gold-mounted walking stick, suitably inscribed.

Regret has been occasioned by the retirement of MR. WM. EMMOTT, of the telegraph department at Burnley Post Office, after 48 years' service. Mr. Emmott first joined the old Magnetic Co. before the Government took over the telegraphs. His present official position is superintendent of telegraphs and telephones.

MR A. A. KING, who has been chief representative for the firm of G. Straus & Co., Ltd., 211, Upper Thames Street, London, E.C., for the past 12 years, has been appointed a director of the company, with a seat on the board. He will still continue to represent them in the country.

Obituary.—The death took place on December 31st of MR. ABRAHAM RIDGWAY, electrical engineer, of 126, Hall Ings, Bradford. About 18 months ago the deceased gentleman had a stroke, from which he never fully recovered, and this was the eventual cause of his death. He died at his residence, 91, Greenwood Terrace, St. Margaret's Road, Bradford. Mr. Ridgway was a well-known local electrical engineer, his premises being situated in the centre of the city, and amongst the huge wool warehouses for which Bradford is noted. He had been in business about nine years, and the concern will now be carried on on behalf of the widow by the deceased's three sons.

MR. F. J. BUDD.—The death is announced, after two months' painful illness, of Mr. F. J. Budd, of Little Heath, Old Charlton, S.E., late chief of the O.C. department of Messrs. Siemens Bros. and Co., Ltd., of Woolwich. Deceased was 49 years of age, and was a leading member of the Union Waterloo Lodge of Freemasons

We regret to learn of the death, on the 1st inst., from pneumonia, of Mr. W. W. Alston. Mr. Alston held the position of chief assistant electrical engineer to the West Bromwich Corporation for the past nine years, and previously he had seen service under the Bury, Oldham and Bermondsey Councils.

NEW COMPANIES REGISTERED.

Electric Mirror Publicity, Ltd. (132,987).—This company was registered on December 23rd, with a capital of £500 in £1 shares, to carry on the business indicated by the title, and that of mechanical and electrical engineers, founders, &c. The subscribers (with one share each) are:—G. Reiche, Hendara, Dunoon Road, Forest Hill, S.E., secretary; A. J. Clarke, 127, Abbeville Road, Clapham Park, S.W., secretary. Private company. Table "A" mainly applies. Registered office, 122, Southampton Row, W.C.

Edwards & Armstrong, Ltd. (132,986).—This company was registered on December 23rd, with a capital of £10,000 in £1 shares, to take over the business of electrical and mechanical engineers carried on by J. H. Edwards and A. L. Stephens at 127, Victoria Street, Bristol, as "Edwards and Armstrong." The subscribers (with one share each) are: J. H. Edwards, 127, Victoria Street, Bristol, electrical engineer; A. L. Stephens, 127, Victoria Street, Bristol, electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are J. H. Edwards and A. L. Stephens; qualification, £100. Registered by Jordan and Sons, Ltd., 116-17, Chancery Lane, W.C.

National Wire Manufacturing Co., Ltd. (132,995).—This company was registered on December 23rd, with a capital of £12,000 in £1 shares, to carry on the business of engineers, wire drawers and workers, galvanisers, wire rope manufacturers, cable makers, tube drawers, cycle manufacturers, &c. The subscribers (with one share each) are: R. D. Conner, 5, Neston Avenue, Withington, Manchester, engineer; R. P. Slinger, 33, Smedley Road, Cheetham Hill, Manchester, engineer; J. C. Jones, Redland House, Withington, Manchester, gentleman; W. Royle, Prestwich, Manchester, gentleman; J. B. Jones, Redland House, Withington, Manchester, gentleman; Miss K. F. Jones, Redland House, Withington, Manchester; Mrs. E. M. Conner, 5, Neston Avenue, Withington, Manchester. Private company. The number of directors is not to be less than three or more than seven; the first are R. D. Conner, R. P. Slinger, J. C. Jones and W. Royle, each of whom may retain office while holding 1,000 shares; secretary, R. D. Conner. Registered office, Monsall Road, Newton Heath, Manchester.

Pitter's Ventilating and Engineering Co., Ltd. (132,967).—This company was registered on December 22nd, with a capital of £30,000 in £1 shares (12,000 preferred participating), to carry on the business of iron-founders, mechanical and electrical engineers, &c., and to acquire from Pitter's Patents, Ltd., certain exclusive licences in respect of improvements in the construction of propellers as applied to ventilating. The subscribers (with one preferred participating share each) are:—The Hon. Schomberg C. Trefusis, 20, Bishopsgate, E.C., insurance broker; P. G. Clegg, 10, Bishopsgate, E.C., accountant; W. C. Pitter, 23, Nightingale Vale, Woolwich, S.E., engineer. Private company. The number of directors is not to be less than two or more than seven; the first are the Hon. Schomberg C. Trefusis, P. G. Clegg and W. C. Pitter; remuneration, £100 each per annum (chairman, £150). Registered by Francis & Johnson, 19, Great Winchester Street, E.C.

R. Herbert & Co., Ltd. (133,085).—This company was registered on December 30th, with a capital of £1,000 in £1 shares, to take over the business carried on at 6, Station Road, Brixton, and 33, St. Martin's Road, Stockwell, S.W., by R. N. Herbert, as "R. Herbert & Co.," and to carry on the business of electrical and motor engineers and manufacturers of, and dealers in, motor requisites, transformers, arc and metal-filament lamps, bells, fans, &c. The subscribers are:—R. N. Herbert, 33, St. Martin's Road, Stockwell, S.W., electrician, &c.; J. Hall, 78, Devonshire Road, Palmer's Green, N., builder and decorator. Private company. The number of directors is not to be less than two or more than five; the first are R. N. Herbert and J. Hall. Registered office, 6, Station Road, Brixton, S.W.

Fardon & Carpenter, Ltd. (133,073).—This company was registered on December 30th, with capital £2,002 in £1 shares, to take over the business of electrical engineers carried on by G. R. Fardon and C. A. Carpenter, at 4, Maidenhead Court, and 8 and 9, Glasshouse Yard, Aldersgate Street, E.C., as "Fardon & Carpenter." The subscribers (with one share each) are:—G. R. Fardon, 143, Percy Road, Shepherd's Bush, electrical engineer; C. A. Carpenter, 149, Dalmally Road, Addiscombe, Croydon, electrical engineer. Private company; the first directors are G. R. Fardon C. A. Carpenter, and E. J. Sandham (all permanent); qualification (except E. J. Sandham), £300; remuneration of two first-named directors £156 each, per annum. Registered by Lydall & Sons, 87, John Street, Bedford Row, W.C.

Mansfield Engineering Co., Ltd. (133,017).—The company was registered on December 24th, with a capital of £10,000 in £1 shares, to take over the business of mechanical and electrical engineers, machine and engineering tool makers, boilers makers, iron and brassfounders, &c., carried on by J. W. Houfton and C. A. Houfton at Mansfield and elsewhere as the Mansfield Engineering Co. The subscribers (with one share each) are:—J. W. Houfton, Woollerins, The Park, Mansfield, engineer; C. A. Houfton, Parkside, Mansfield, engineer. Private company. The number of directors is not to be less than two or more than five, the first are J. W. Houfton and C. A. Houfton; qualification, 250 shares. Registered office, Recreation Street, Mansfield, Notts.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Coatbridge and Airdrie Electric Supply Co., Ltd.—Charge on the company's undertaking and property, present and future, including uncalled capital and Coatbridge and Airdrie undertakings and benefit of certain agreements, &c., dated December 18th, 1913, to secure £2,500. Holders: County of London Electric Supply Co., Ltd., Moorgate Court, Moorgate Place, E.C.

Ferranti, Ltd. (83,718).—Capital, £130,000, in 60,000 pref., 60,000 ord. and 10,000 def. shares of £1 each. Return dated November 10th, 1913. 53,374 pref., 60,000 ord. and 10,000 def. shares taken up, £123,374 considered as paid. Mortgages and charges: £145,762 10s. 4d.

United Electric Tramways Co. of Caracas, Ltd.—Capital, £200,000 in £1 shares. Return dated November 13th, 1913. 170 000 shares taken up, £7 paid, £169,993 considered as paid. Mortgages and charges: £165,750.

Davis & Clark, Ltd.—Debentures, charged on the company's undertaking and property, present and future, including uncalled capital, dated December 19th, 1913, to secure £235, have been filed. Holder: A. A. Barnes, 20, Hamsell Street, E.C.

Cleveland and Durham Electric Power Co., Ltd. (89,539).—Particulars of £225,000 second debs., created September 29th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

W. A. Stevens, Ltd.—A memorandum of satisfaction in full on November 25th, 1913, of debs. dated August 7th, 1912, securing £5,000, has been filed.

Cleveland and Durham Electric Power Co., Ltd.—A memorandum of satisfaction in full (*a*) on December 15th, 1913, of mortgage or charge dated August 10th, 1907, securing an amount not exceeding £5,000; (*b*) on December 19th, 1913, of deb. dated December 11th, 1913, of deb. dated December 11th, 1907, securing £100,000; (*c*) on same date, of deb. dated March 31st, 1909, securing £10,000; (*d*) on same date, of deb. dated December 11th, 1907, securing £6,000; and (*e*) on same date, of second mortgage debs. bearing various dates, from October 5th, 1908, to July 24th, 1911, securing £225,000, have been filed.

Liverpool District Lighting Co., Ltd.—A memorandum of satisfaction in full on December 24th, 1913, of debs. dated October 13th, 1911, and February 9th, 1910, securing £2,000 and £6,000 respectively, has been notified. Particulars of £15,000 debs., created December 24th, 1913, also filed, pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, including uncalled capital. No trustees.

British Prometheus Co., Ltd.—Particulars of £5,000 second debentures, created September 17th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the amount of the present issue being £3,000. Property charged: The company's undertaking and property present and future, including uncalled and unpaid capital. No trustees.

Keynsham Electric Light and Power Co., Ltd.—Particulars of £1,500 third debentures, created December 15th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the amount of the present issue being £1,000. Property charged: The company's undertaking and property, present and future, including uncalled capital, and four messuages situate at Keynsham, Som. No trustees.

Gosport and Alverstoke Electric Lighting Co., Ltd. (82,693).—Capital, £5,000 in £10 shares. Return dated December 5th, 1913. All shares taken up. £5,000 paid. Mortgages and charges: Nil.

Tramways (M.E.T.) Omnibus Co., Ltd.—Particulars of debs., for an amount not exceeding the issued capital for the time being created by resolutions of January 22nd, 1912, and December 16th, 1913, and secured by trust deeds dated March 14th, 1912, and December 24th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £100,000, ranking *pari passu* with £100,000 deb. stock already issued. Property charged: 19s. per share uncalled on 200,000 shares and company's undertaking and other property, present and future. Ttustees: Electric and General Investment Co., Ltd., 1 and 2, Great Winchester Street, E.C.

Hampshire Light Railways (Electric), Ltd. (52,564).—Capital, £1,000 in £10 shares. Return dated December 5th, 1913. All shares taken up. £1,000 paid. Mortgages and charges: Nil.

Delagoa Bay Development Corporation, Ltd. (76,099).—Return dated November 14th, 1913. Capital, £166,800 in 10s. shares, 267,400 shares taken up, £88,700 paid, £45,000 considered as paid. Mortgages and charges: £195,200.

CITY NOTES.

Buenos Ayres Port and City Tramways, Ltd.

MR. G. KITCHIN presided at the meeting of this company held at Salisbury House, E.C., on December 15th. He said that last year they had no reason to anticipate so lamentable a report as had been issued, consequent upon the enormous rise in the already heavy rates of working coste. Messrs. J. G. White & Co., Ltd., prepared a bulky report upon the physical and general conditions of the property. The receipts had increased by £5,507, but on the debit side of the revenue account was the enormous increase of £15,186 in maintenance and repairs—permanent way, £2,136; electrical equipment, £673; and cars and car bodies the astonishing amount of £12,361. In the previous year severe inundations injured their permanent way, damaged car motors, and held up the traffic, and they were told that such floods were unprecedented. There seemed reason to suppose that they might be of frequent occurrence. The receipts increase was about 8½ per cent., and the expenses increase 42 per cent. The actual loss on working was £1,148. It was impossible to look at the figures without coming to the conclusion that there must have been grave neglect on the part of the management in Buenos Ayres to have led to such a disastrous result, so different from what they were given to expect if a free hand were given to those in control. It was as yet too early to judge what would be the result of the new management when it should have had time to make itself felt. The current year's returns were showing a distinct improvement on those of the latter part of 1912, but were not such as to hold out any immediate hope of sufficient improvement in the financial circumstances to give confidence in the company's future. The chairman referred to the exceptional difficulties under which the concern was worked. Dr. M. Lacroze and Mr. J. B. White were going to Buenos Ayres to examine into the condition of the property, and to consult with the local committee, and when the shareholders met next June he anticipated being able to put a more satisfactory statement before them.

The report was adopted.

Rio de Janeiro Tramway, Light and Power Co., Ltd.—A dividend of 1¼ per cent. is announced.

Sao Paulo Tramway, Light and Power Co., Ltd.—A quarterly dividend of 2½ per cent. is announced.

Reduction of Capital.—The British Coalite Co., Ltd., reduced a petition for confirmation of the reduction of capital from £2,000,000 to £400,000 has been presented and will be heard on January 13th.

Japan.—The Katsuragawa Water Power Co. reports a net profit of £17,069 for the last financial year. Of this sum, £14,000 is being distributed to the shareholders in the form of a 5 per cent. dividend; £1,710 is being placed to reserve, £782 to a sinking fund; and £500 is being allotted to bonuses, leaving a small balance to be carried forward.—The Kinngawa Water Power Co., which is now supplying 260,000 KW. per day to the Tokio Electric Bureau, is declaring a dividend of 6 per for the last half-year.

Continental.—FRANCE.—The report of the Compagnie d'Electricité de l'Est-Parisien (Est-Lumière), of Paris, for the year ending June 30th last, shows a net profit of £24,327. A sum of £1,217 is being placed to reserve, £710 is being distributed in bonuses, and a dividend of 7 per cent., which absorbs £22,400, declared.

La Compagnie d'Electricité de l'Ouest Parisien (Ouest-Lumière) reports a profit of £117,274, an increase of £35,322 over the preceding 12 months. Of this sum, £40,000 is being placed to depreciation account, £3,850 to legal reserve, and £70,000 distributed to the shareholders in the form of a 7 per cent. dividend, leaving a small balance to be carried forward.

BELGIUM.—La Société des Centrales Electriques des Flandres, in its report for the last financial year, states that it has secured the concession for the electric lighting of 25 communes, and is in negotiation with 15 others in Western Flanders. It has also secured the contract for the supply of current to the works on the banks of the ship canal between Ghent and the Dutch frontier. The company is building a new generating station at Langerbrugge, near the ship canal, and the first part of the plant, to the extent of 4,000 KW., is expected to be put in operation by the end of the present month. Provision is, however, being made for the extension of the same to a total capacity of 10,000 KW.

La Société d'Electricité du Brabant of Oisquercq, which has a capital of £100,000, now controls the electric lighting concessions in respect of no less than 17 communes in the province of Brabant. It has also contracted with the Compagnie Generale du Gaz pour la France et l'Etranger, which owns the gas and electric supply concessions for the town of Hal, to supply all the current required for electric lighting and power purposes during the period the concession runs. The plant at the generating station at Oisquercq comprises two 2,000-KW. steam turbines and dynamos, two 500-KW. steam engines and generators, and one 1,000-KW. set.

RUSSIA.—The Russische Gesellschaft für Elektrische Rayonstationen is the name of a new company which has just been formed in St. Petersburg, with a capital of £421,660, to group and develop the interests in Russian electrical undertakings of the Deutsche Bank and the Elektrische Licht und Kraftanlagen Gesellschaft, of Berlin.

SPAIN.—A meeting of the shareholders of the Hidroelectrica Espanola has sanctioned the increase of the company's capital from 12,000,000 to 15,000,000 pesetas, with a view mainly, after paying off certain floating debts, to the acquisition of concessions to develop the Dos Aguas and Villora waterfalls on the River Cabriel, in the Province of Cuenca, in order to supply electric energy to Madrid, Valencia, Alcoy, and Cartagena. To develop the Villora falls the Hidroelectrica del Salto de Villora was formed in 1903, the available forces there being estimated at 9,000 H.P. With the development of the new waterfalls, it will be possible to dispense with a steam-driven station and secure a volume of water sufficient in all seasons, the completion of all the installations creating a revenue sufficient to pay 6 per cent. interest, 5 per cent. dividends, and lay by other needful reserves.—*Electron.*

Bahia Tramways, Light and Power Co.—According to a circular issued by the London Committee to the debenture-holders, the municipality has been unable to carry out the terms of the contract of sale. It is proposed to enter into a provisional contract with the municipality, under which the latter will create external gold bonds, to be issued at 84 per cent., bearing interest at 6 per cent., which the company will endeavour to realise, applying the proceeds in payment of the amount due from the municipality.

Stock Exchange Notices.—The Committee has ordered the undermentioned to be quoted in the Official List:—

American Telephone and Telegraph Co.—$29,077,800 additional convertible 4½ per cent. gol dbonds.

The Bank Rate.—The Bank Rate was yesterday reduced from 5 to 4½ per cent.

STOCKS AND SHARES.

Tuesday Evening.

THE New Year has brought an increase in business to the Stock Exchange, and a better tone in several of its markets. Gilt-edged securities cannot claim to have led prices in the upward direction, because there has been a fresh outbreak of dulness in Consols consequent upon more new issues, and promises—or threats—of others to come in the near future. The news from Mexico remains conflicting; and notwithstanding rallies in prices of railway stocks connected with that country, the various securities of the utility undertakings are very depressed.

The Electricity Supply market continues quiet and steady. In spite of its placid character, however, keen discussion is raging around the suggested scheme for consolidating the interests of the London electric supply undertakers. The Stock Exchange is not taking any prominent part at present, but, of course, the developments are being watched with keen attention, and those who are interested have fairly decided opinions of their own upon the various points connected with the issue. Kensington Ordinary, with ⅛ rise, are almost the only shares in the list to show any movement.

The Home Railway market should at this season of the year be showing a good deal of activity, consequent upon dividend estimates, to be set at rest shortly by the declarations from the leading companies for the second half of 1913. This year, however, the position is so complicated by reason of the companies having to alter the form of their accounts, that speculation is somewhat at a loss how, and what, to estimate. Dealers complain that, although the so-called reforms may be of much practical use hereafter, they have laid a heavy check upon business at the present time—as they did also six months ago.

The firmest part of the market is that concerned with Undergrounds, Metropolitans in particular having been strong, with a ump to 46¾ upon rumours that the Company is flirting with one of the big lines. This time it is the Great Central which is supposed to be making the advances. From the top price there has been a slight recession, but Mets. are a point higher on the week. Districts have fallen a ¼, there being something of a bull account in the stock, and the market is wondering a good deal how the results of the past twelvemonth will be found to have materialised as regards net profits. The London and South-Western Company has announced sweeping reductions in suburban fares, but the changes are not expected to influence the receipts of the Undergrounds to any unfavourable extent; indeed, it is conceivable they may benefit them rather than the reverse. Underground Electrics are an improving market. London United Tramways Debenture, British Electric Tractions, and London and Suburban issues remain steady.

Amongst Latin Canadians, the falls in Mexicans attract most attention. The common shares of both the Mexican Light and

Power and the Tramways Companies have dropped sharply, while the bonds of each are flat. A bank holiday extending over two months has been proclaimed, and every day brings its own tale of fierce fighting on this border or the other. The Stock Exchange argument runs that the worse the situation gets, the better will it be, inasmuch as it must bring within closer perspective the ultimate settlement, but this is sorry consolation for holders of the securities in companies apart from the railways. Rumour has been toying with the statement that the Mexico Tramways was threatened by the Mexican Government; the shares fell to 62, rallying to 65 upon reported contradiction of the vague gossip.

Monterey Debenture fell 3 points. Canadian descriptions, too, are out of favour, the incessant demands of the Dominion for fresh capital causing a good many people to regard Canadian investments at the present time with a feeling akin to suspicion, while almost every mail that arrives brings with it also statements of the scarcity of actual money which prevails in many parts of Canada. The Shawinigan Water Company has declared its regular dividend at the rate of 6 per cent. on the common stock, and the price thereupon gained a point.

Brazilian things are in little better case than Canadians. Severe shrinkages during the past week or two in shares of the Brazil Railways have unnerved proprietors of other stocks and shares connected with the Republic. It takes little selling badly to disturb prices. Para Electric Preference, for example, fell ⅜ early this week upon the offering of comparatively few shares. The flatness of most things Brazilian is connected in some measure with the default recently made by the Para Improvements Company, but there has been a rally from the lowest prices touched in certain of the Brazil issues which fell most severely. Brazilian Tractions fell back to 82½, recovering therefrom to their previous price of 84.

The feature of the Telegraph section is a brisk rise in the price of Marconis. Statements are in circulation to the effect that the Marconi Marine Company is doing excellently, and is likely to extend still further its scope: upon this, the parent shares picked up to 3 7/16, having been down to 3¼ since our last notes were written. Languid speculation was stirred by the movement, and the subsidiaries—Americans, Canadians and Spanish—hardened a trifle in sympathy. Telegraph stocks and shares have been quiet.

The Manufacturing group is noticeable principally for an advance of ⅜ in British Insulated and Helsby shares, which raised the quotation to 8¾. The rises of the Brush stocks are well maintained. India-Rubbers are *ex* dividend, both as regards Ordinary and Preference. Willans & Robinson Preference have held the remarkable improvement which they secured at the end of last year, and the Debenture stock is 3 higher. A decided change has come over the rubber share market upon a slight improvement in the price of the product. It is expected that the alteration in selling methods—which, according to gossip, will shortly be put into practice—will help to put the price of rubber on a higher plane; and, in anticipation, the bears are getting back their stocks in Mincing Lane and Throgmorton Street. There is not much public about the movement up to the present, but were rubber itself to move up to half-a-crown per lb. and stop there, outside attention might be reattracted to the market.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	Inc.
		£	£		£	£		
Bath	Dec. 31	3,166	+ 95	53	50,149	+ 4,695	..	..
Blackpool-Fleetw'd	„ 27	1,196	+ 189	25	30,270	+ 4,928	8	..
Bristol	„ 31	32,884	+2,881	..	419,539	+54,605	30·5	..
Brit. Elec. Trac. Co.	„ 26	190,354	— 217	..	..	..	429·8	1·25
Chatham and Dist.	„ 25	3,529	+ 129	51	47,453	+ 2,947	14·98	..
Cork	„ 31	1,774	+ 2	53	25,980	+ 716	9·89	..
Dublin	„ 26	20,995	—1,784	..	281,263	—17,398	54·25	..
Hastings	Jan. 1	3,213	+ 7	..	..	+ 3,787	19·3	..
Lancashire United	Dec. 31	6,255	+ 541	52	81,543	+10,197	42	8
Llandudno-Col. Bay	„ 26	567	— 10	4	567	— 10	6·5	..
London United ..	„ 26	28,747	+ 549	..	825,598	+ 6,772	..	..
Tyneside	„ 24	1,928	— 219	26	12,931	+ 518	11	..
Anglo-Argentine ..	„ 31	253,900	+16,082	52	3,917,249	+209,088	..	..
‡Auckland	..	..	..	..	..	..	25·42	1·91
Brisbane	Nov.	27,053	+2,743	..	287,071	+58,650	..	..
Calcutta	Dec. 27	17,959	+ 861	52	..	+10,209	..	..
Kalgoorlie, W.A. ..	Nov.	2,504	..	48	31,603	..	20·5	..
†Madras	Dec. 31	3,858	+ 305	52	42,946	+ 3,074	15·25	..
Montevideo ..	Dec.	33,309	—1,174	4	63,889	— 267	..	..
Cen. London Rly.	Dec. 27	20,795	—1,000	52	254,195	+ 4,322	6·78	·4
City & S. Lon. Rly.	„ 27	11,542	—1,472	52	144,983	—14,184	7·26	..
Dublin-Lucan Rly.	„ 31	625	+ 34	26	8,859	+ 13	7	..
L'pool Overh'd Rly.	„ 28	6,653	+ 348	52	88,979	+ 6,645	6·6	..
London Elec. Ry. Co.	„ 27	58,050	+ 245	52	711,595	+ 970	21·25	..
Mersey Railway ..	„ 27	8,930	— 245	52	116,063	+ 4,457	4·5	..
Metropolitan Rly.	„ 28	72,614	+5,965	52	902,258	+35,507	29·25	3·5
Met. District Rly.	„ 27	52,439	+1,147	52	675,747	+18,890	25	..

† Two weeks. ‡ No returns available owing to strike.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, January 7th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	per lb.	3d.	..
a „ Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	„	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£30 10	..
a Bleaching powder	„	£6 5	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£17 10	..
a Copper Sulphate	„	£22 10	..
a Lead, Nitrate	„	£29 10	..
a „ White Sugar	„	£28	..
a „ Peroxide	„	£32	..
e Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (88/90 %) ..	per ton	£22 10	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	„	7½d.	..
a Shellac	per cwt.	89/-	3/- dec.
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	„	£8 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70/72 %) ..	„	£10 5	..
a „ Chlorate	per lb.	3½d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£90	£6 dec.
b „ Wire, in ton lots (1 to 14 S.W.G.)	„	£116 13 4	£4 13 4 dec.
b „ Sheet, in ton lots ..	„	£112	£14 dec.
p Babbitt's metal ingots	„	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7½d.	..
c „ Tube (brazed)	„	9¾d.	½d. inc.
c „ „ (solid drawn)	„	8¾d.	½d. inc.
c „ Wire, basis	„	7¾d.	..
c Copper Tubes (brazed)	„	10¾d.	½d. inc.
c „ „ (solid drawn)	„	10¾d.	½d. inc.
g „ Bars (best selected) ..	per ton	£83	£1 inc.
g „ Sheet	„	£83	£1 inc.
g „ Rod	„	£83	£1 inc.
d „ (Electrolytic) Bars	„	£68 10	£1 10 inc.
d „ „ Sheets	„	£86 10	£1 10 inc.
d „ „ Rods	„	£74	£1 10 inc.
d „ „ H.C. Wire	per lb.	8¼d.	..
f Ebonite Rod	„	4/6	..
f „ Sheet	„	4/-	..
n German Silver Wire	„	1/10	..
h Gutta-percha, fine	„	7/-	..
h India-rubber, Para fine	„	8/1½	½d. inc.
j Iron Pig (Cleveland warrants) ..	per ton	50/1	1d. inc.
„ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Pig	„	£19	10/- inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7 10	..
e Mica (in original cases) small ..	per lb.	6d. to 8s.	..
e „ „ „ medium	„	8/6 to 6/-	..
e „ „ „ large ..	„	7/6 to 11/-	..
o Nickel, sheet, wire, &c.	„	8/6 to 4/6 nom	..
p Phosphor Bronze, plain castings	„	1/1 to 1/3½	..
p „ „ rolled bars & rods	„	1/0¾ to 1/5	..
p „ „ rolled strip & sheet	„	1/2½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10½d.	..
r Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£169 10 to £170 10	£1 dec.
n „ Wire, Nos. 1 to 16	per lb.	2/5	..
p White Anti-friction Metals ..	per ton	£44 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£25 12 6	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Mexican Northern Power Co., Ltd.—The company announces that in the present disturbed condition of Mexico it is necessary to defer payment of bond interest due January 1st. It is not possible yet to make definite plans for the resumption of work or for raising funds to complete the development of the undertaking. No direct damage has been caused to the company's property by the military operations.

Holophane, Ltd.—At the meeting of this company held at Caxton Hall, S.W., on December 30th, Mr. A. O. Mygatt said that the business had increased by 50 per cent. in the net sales during the year, but sales had fallen off towards the end of the year by the competition of new lines of cheaper white glass. The year's operations had been accompanied by internal disputes, litigation, &c., which had prevented sufficient attention being given to technical developments.

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations Jan. 6th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	* 1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	3 13/16 — 4 3/16	..	6 8 0
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	11¾ — 13¾	..	..
Do. Do. Deferred	100	..	..	4¾ — 6	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	87 — 90	+2	6 13 4
Do. 7 % Non-Cum. Pr'f.	100	3	..	52 — 55	..	5 9 1
Do. 5 % Perp. Deb.	100	5	5	92 — 95	..	5 5 5
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 80	..	5 12 6
Central London Railway, Ord.	100	3	3	61 — 66	..	4 11 0
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 3
Do. Pref.	100	4	4	70 — 75	..	5 6 8
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 3
Do. Def.	100	2	..	60 — 65	..	3 1 7
Do. Gtd. Assented	100	..	4	78 — 80	..	5 0 0
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	96 — 98	..	5 2 0
Do. Do. 1896	100	5	5	96 — 98	..	5 2 0
Do. Do. 1901	100	5	5	95 — 97	..	5 3 1
Do. Do. 1903	100	5	5	93 — 95	−1	5 5 0
Do. 4 % Deb.	100	4	4	89 — 91	..	4 8 0
Hastings Trams, 6 % Pref.	1	6	6†	3/4 — 3/4	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	66 — 71	..	6 6 9
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 13 4
Do. 4 % Deb.	100	4	4	71 — 76 xd	..	5 5 3
Lancashire United, 5 % Deb.	100	5	5	75 — 79 xd	..	6 6 7
London and Suburban, Ord.	1	..	..	1/32 — 3/32	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	1/32 — 3/32	+ 1/32	6 16 9
Do. Do. 4½ % 1st Deb.	100	4½	4½	72 — 77 xd	..	5 17 0
London Elec. Railways, 4 % Deb.	100	4	4	88 — 90 xd	..	4 9 0
London United Trams, 4 % Deb.	100	4	4	57 — 61 xd	..	6 11 2
Metropolitan Railway Consol.	100	1⅝	1¼†	46½ — 47	+1	3 9 2
Do. Surplus Lands	100	2⅜	2⅜†	58 — 60	..	4 11 8
Do. 3½ % Deb.	100	3½	3½	83 — 85	..	4 2 4
Do. 3½ % Pref.	100	3½	3½	78 — 80	..	4 7 6
Do. 3½ % Con. Pref.	100	3½	3½	75 — 77	..	4 11 0
Metropolitan District Ord.	100	Nil	..	31½ — 32	— ½	Nil
Do. 6 % Deb.	100	6	6	133 —136 xd	..	4 8 3
Do. 4 % Deb.	100	4	4	90 — 92 xd	..	4 7 0
Do. 4 % Prior Lien	100	4	4	94 — 96	+1	4 3 4
Do. 4½ % First Pref.	100	4½	4½	81 — 83	..	5 8 5
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	80 — 84 xd	..	5 7 2
Do. 5 % Deb.	100	5	5	86 — 89	..	5 12 0
Potteries, Ord.	1	3½	..	5/16 — 7/16	..	..
Do. 5 % Pref.	1	5	5	11/16 — 13/16	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
South Metro. Trams, 6 % Pref.	1	6	6†	2 — 2½	..	8 0 0
Do. 4 % Deb.	100	4	4	66 — 70 xd	..	5 14 4
Underground Elec. Railways	10	..	..	3½ — 3¾	..	Nil
Do. "A"	1/-	..	..	3/8 — 7/16	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	112 —114	+1	5 5 2
Do. 4½ % Bonds	100	4½	4½	97 — 99 xd	..	4 11 0
Do. 6 % Income	100	6	6	90 — 91	+1½	6 11 10
Yorkshire (West Riding), Ord.	5	Nil	..	1/4 — 1/2	..	Nil
Do. 6 % Pref.	5	3	4	3½ — 4	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	79 — 84	−1	5 7 2

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4¼ — 4⅜ xd	..	5 11 4
Do. 2nd Pref.	5	5½	5½	4 3/16 — 4 5/16 xd	..	6 3 11
Do. 4 % Deb.	100	4	4	88 — 90 xd	..	4 9 0
Do. 4½ % Deb.	100	4½	4½	96 — 98 xd	..	4 11 10
Do. 5 % Deb.	100	5	5	97½ — 99½	+ ½	5 0 6
Auckland Trams, 5 % Deb.	100	5	5	100 —102 xd	..	4 18 0
Bombay Elec. S. & Trams, Pref.	10	6	6	10¾ — 11¼	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	92 — 94 xd	..	4 15 9
Do. 5 % 2nd Deb.	100	5	5	95 — 98 xd	..	5 2 0
Brazilian Traction, Light and Power	$100	6	6†	83 — 85	..	7 1 2
Brisbane Trams Invt., Ord.	5	8	8	7¾ — 7¾	..	5 3 3
Do. 5 % Pref.	5	5	5	4¾ — 5⅛	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	96 — 99 xd	..	4 11 0
B. Columbia Elec. Rly., Def.	100	8	8†	104 —108	+1	7 8 10
Do. Pref. Ord.	100	6	6	102 —106	..	5 13 2
Do. 5 % Pref.	100	5	5	102 —105	..	4 15 3
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 —101	..	4 9 1
Do. 4½ % Vancouver Deb.	100	4½	4½	100 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	92 — 95	..	4 9 6
Calcutta Trams, Ord.	5	7½	5†	6 — 6¼	..	5 15 5
Do. 5 % Pref.	5	5	5	4¾ — 5⅛ xd	..	4 17 7
Do. 4½ % Deb.	100	4½	4½	93 — 96 xd	..	4 13 9
Cape Electric Trams	1	5	5	3¼ — 3⅜	..	6 19 0
City Buenos Aires Trams (1904)	5	5†	5	5¼ — 5⅜	..	4 10 11
Do. 4 % Deb.	100	4	4	91 — 96 xd	..	4 3 4
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	88 — 92	..	5 8 8
Havana Elec. Rly., 5 % Bonds	$1000	5	5	94½ — 98½	..	5 1 6
Kalgoorlie Elec. Trams	1	Nil	..	0 — 1/16	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	3	..	10 — 20	..	Nil
La Plata Elec. Trams, Ord.	1	..	..	3/8 — 1/2	..	..
Do. Pref.	1	4½d.	6	3/4 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1⅜ — 1⅝	..	4 7 3
Do. 6 % Pref.	1	6	6	1⅜ — 1 7/16 xd	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6% Cum. Pref.	5	6	6	4¾ — 5¼	..	5 14 3
" Elec. Tr. (1904), Deb.	100	5	5	99 —101 xd	..	4 19 0
Manaos Trams & Lt., 1st Deb.	100	5	5	79 — 82 xd	..	6 2 0
Manila Elec. R. and Ltg., Bonds	$1000	5	5	96½ — 98½	..	5 1 6
Mexico Trams Com	$100	7	7	63 — 66	−2	10 15 4
Do. Gen. Con. 5 % Bonds	..	5	5	76 — 80	−1½	6 5 0
Do. 6 % Bonds	100	6	6	75¼ — 78½ xd	−1½	7 12 10
Para Elec. Rlys. & Lt., Ord.	5	10	10†	5⅜ — 6	..	8 6 8
Do. 6 % Pref.	5	6	6	4⅜ — 4⅝	— ⅛	6 9 9
Do. 5 % 1st Deb.	100	5	5	93½ — 95½	−1	5 4 6
Perth (W.A.) Elec. Tr., Ord.	1	5½	..	1⅛ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 — 5½ xd	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	94½ — 96½ xd	..	4 13 3
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	97⅛ — 99½ xd	..	4 19 6
Do. 5 % Mort. Bonds	100	5	5	90 — 92	..	5 8 9
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	97 —100	..	5 0 0
Singapore Trams, 5 % Deb.	100	5	5	86 — 90	..	5 11 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95	..	5 5 3
Un. Elec. Trams Monte Video	5	7	7	4⅜ — 4⅞	..	7 3 7
Do. 6 % Pref.	5	6	6	4⅞ — 5⅛	..	5 17 1
Do. 5 % 1st Deb.	100	5	5	93¾ — 96¾	..	5 3 8
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	95 — 97	..	4 12 9

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

Bournemouth & Poole, Ord.	* 10	6	5†	9 — 10	..	4 14 9
Do. 4½ % Pref.	10	4½	4½	8¾ — 9¼	..	6 0 0
Do. Second 6 % Pref.	10	6	6	10 — 10½	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	93 — 96 xd	..	4 13 9
Brompton & Kensington, Ord.	5	10	9†	8¾ — 9¼	..	4 9 9
Do. 7 % Cum. Pref.	5	7	7	8¼ — 8½	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	90 — 93	..	4 6 0
Charing Cross, West End & City	5	5	5†	4¼ — 5	..	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4 — 4¼	..	5 0 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞ — 4 xd	..	5 12 6
Do. Do. 4 % Deb.	100	4	4	90 — 92	..	4 8 0
Chelsea, Ord.	5	5	4†	4⅝ — 5⅛	..	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	94 — 97 xd	..	4 12 9
City of London, Ord.	10	9	6†	16¾ — 17½	..	5 2 10
Do. 6 % Cum. Pref.	10	6	6	13 — 14	..	4 5 9
Do. 5 % Deb.	Stock	5	5	114 —118 xd	..	4 4 9
Do. 4½ % Second Deb.	100	4½	4½	97½ — 99½xd	+ ½	4 10 6
County of London, Ord.	10	6	5†	11⅜ — 12½	..	4 18 0
Do. 6 % Pref.	10	6	6	11¼ — 12	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	101 —103 xd	..	4 7 5
Do. 4½ % Second Deb.	Stock	4½	4½	98 —101	..	4 9 1
Edmundson's, Ord.	£3	..	..	5/16 — 7/16	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3¾ — 4⅛	..	7 1 2
Do. 6 % Non-Cum. Pref.	5	..	..	1¼ — 1⅜	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	80 — 83	..	5 8 5
Folkestone	5	6	6	4⅜ — 4⅝	..	6 3 1
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 4⅝	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	89 — 91	..	4 19 0
Hove	5	8	8†	8⅜ — 9⅛	..	4 17 3
Kensington & Knightsbridge, Ord.	5	8	8†	7⅞ — 8¼	+ ⅛	4 17 0
Do 4 % Deb.	Stock	4	4	90 — 92	..	4 7 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	76 — 80	..	5 12
London Electric, Ord.	3	2½	..	1⅛ — 1⅜	..	4 12 7
Do. 6 % Pref.	5	6	6	4¼ — 5¼	..	5 14 8
Do. 4 % First Mort. Deb.	Stock	4	4	90 — 93	..	4 6 3
Metropolitan	5	4	4†	3⅜ — 3⅝	..	5 6 8
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅝	..	4 14 9
Do. 4½ % First Mort. Deb.	Stock	4½	4½	95 — 98 xd	..	4 11 10
Do. 3½ % Mort. Deb.	Stock	3½	3½	78 — 81 xd	..	4 6 5
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	100 —103	..	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9⅞ — 10½xd	..	5 14 3
Oxford	5	7	6†	6 — 6⅜	..	5 7 8
St. James' and Pall Mall, Ord.	5	10	10†	8¾ — 9	..	6 11 1
Do. 7 % Pref.	5	7	7	6⅝ — 7⅛	..	4 18 3
Do. 3½ % Deb.	100	3½	3½	81 — 84 xd	..	4 3 4
South London, Ord.	4	5⅓	..	2⅞ — 3⅛	..	6 15 4
Do. 5 % First Mort. Deb.	100	5	5	96 — 99 xd	..	5 1 0
South Metropolitan, 7 % Pref.	1	7	7	1 3/16 — 1 5/16	..	5 14 9
Do. 4½ % First Deb. Stock	100	4½	4½	93 — 96	..	4 13 9
Urban, Ord.	£3	Nil	..	3/16 — 5/16	..	..
Do. 5 % Cum Pref.	5	3‡	..	2⅛ — 2⅜	..	5 4 4
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	+1	5 3 6
Westminster, Ord.	5	10	10†	8¾ — 8⅞	..	5 14 3
Do. 4½ % Cum Pref.	5	4½	4½	4 13/16 — 5 1/16	..	4 6 10

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ 3s. Cash and 2% in Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 6th.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	£	6	6†	5⅛ — 5⅜	..	£ s. d. 5 11 7
Calcutta, Ord.	£	8¾	5†	7⅛ — 7⅜	..	5 11 6
Do. 5 % Pref.	£	5	5	4⅞ — 5⅛	..	4 17 7
Calgary Power, 1st Mort. Bds.	100	5	5	88½ — 90½ xd	..	5 9 3
Canadian Gen. El. Com.	$100	7	8	102 —107	—2	7 9 7
Do. 7 % Pref.	$100	7	7	119 —124	..	5 12 11
Cordoba Lt., Power and T., Ord.	1	5	..	⅞ — ⅞	..	7 13 0
Do. 5 % Deb.	100	5	5	91 — 93	..	5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	88½ — 90½	..	6 12 7
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	91 — 94 xd	..	5 6 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	94½ — 96½	..	5 3 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	⅞ — ⅞	..	Nil
Do. 6 % Pref.	1	6	6†	⅝ — ⅝	..	11 5 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	100½ —102½ xd	..	4 17 6
Madras, Ord.	£	Nil	..	1¼ — 1⅜	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	101 —104 xd	..	4 16 0
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	63 — 64	—3½	7 11 6
Mexican Lt. & Power, Common	$100	4	4	35 — 40	—4½	10 0 0
Do. 7 % Cum. Pref.	$100	7	7	74 — 79	..	8 17 2
Do. 5 % 1st Mort. Gold Bds.	..	5	5	76½ — 79½	—1½	6 5 9
Do. 5 % 2nd Mort. Bonds	100	5	5	62 — 67	—4	7 9 3
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	*	1919.	1918.			£ s. d.
	100	5	5	55 — 60	—3	8 6 8
Montreal, Lt., H. and Power	$100	9	10†	216 —222	..	4 10 1
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	10 — 20	..	..
River Plate, Ord.	Stock	10	..	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	101 —106	..	5 18 2
Do. 5 % Deb. Stock	Do.	5	5	93 —100 xd	..	5 0 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 4
Shawinigan Water, Capital	$100	5½	6†	134 —138	+1	4 7 0
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	103½—105½ xd	..	4 14 9
Do. 4½ % Per. Deb.	Stock	4½	4½	96½ — 98½	..	4 11 5
Toronto Power, 4½ % Deb.	Do.	4½	4½	95 — 98	..	4 11 10
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	87 — 89 xd	..	5 12 4
Victoria Falls Power, Pref.	1	6	6	35/32 — 37/32	—1/32	7 2 0
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105	..	5 14 8

MANUFACTURING COMPANIES.

Aron, Ord.	£1	7	..	9/32 — 11/32	..	8 12 4
Do. 6 % Pref.	£1	6	6	3/32 — 5/32 xd	..	8 0 0
Babcock & Wilcox	1	16	14†	2⅞ — 3	+1/16	5 6 8
Do. Pref.	1	6	6	1 5/16 — 1 7/16	..	4 3 6
British Aluminium, Ord.	£1	..	..	1 — 1⅛	..	..
Do. 6 % Cum. Pref.	£1	6	6	25/32 — 27/32	..	6 12 6
Do. 5 % Prior Liens Debs.	100	5	5	92 — 95 xd	..	5 5 0
Do. Deb. Stk.	100	5	5	85 — 87	..	5 15 0
B.I. & Helsby Cables	£5	10	8†	8½ — 8⅝	+1/32	5 16 0
Do. Pref.	£5	6	6	5⅝ — 6¼	..	4 16 0
Do. Deb.	100	4½	4½	99 —102	—1	4 8 3
British Thomson-Houston, Deb.	100	4½	4½	92 — 95	..	4 14 9
British Westinghouse, Pref.	£3	Nil	..	1 1/16 — 1 1/8	..	Nil
Do. Deb.	100	4	4	64 — 67 xd	..	5 19 5
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Brown, Lindley, Ord.	£1	..	..	3/- —3/-	..	Nil
Do. Pref.	£1	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	£2	Nil	..	⅜ — ⅝	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	75 — 80 xd	..	6 5 0
Do. 4½ % Deb.	100	4½	4½	85½ — 40½	..	11 2 2
Do. 4½ % Second Deb.	100	4½	4½	23 — 27 xd	..	16 13 4
Callender's Cable	£5	15	5†	10⅜ — 11⅜	..	6 13 4
Do. Pref.	£5	5	5	4 15/16 — 5 1/16 xd	+1/16	4 18 9
Do. Deb.	100	4½	4½	95 — 98 xd	..	4 8 6
Castner-Kellner	£1	20	22½	23½ — 24½ xd	..	..
Do. Deb.	100	4½	4½	104 —107	..	4 4 1
Crompton & Co., Deb.	100	5	5	66 — 71 xd	..	7 0 10
Dick, Kerr	£1	Nil	..	0/32 — 2/32	..	..
Do. Pref.	£1	6	6	11/16 — 12/16	..	7 2 2
Edison & Swan, A, £2 paid	£5	Nil	..	0 — 1/8	..	Nil
Do. fully paid	£5	Nil	..	1 — 1⅛	..	Nil
Do. 4 % Deb.	100	4	4	55 — 59 xd	..	6 15 7
Do. 5 % Second Deb.	100	5	5	63 — 68	..	7 7 1
Electric Construction	£1	5	..	3/4 — 5/4	..	7 5 6
Do. Pref.	£1	7	7	1 3/16 — 1 5/16	..	6 11 9
Greenwood & Batley, Pref.	£10	7	7	6 13/16 — 7 1/16	..	9 18 2
Do. Deb.	100	5	5	92 — 94	..	5 6 5
General Electric, 6 % Pref.	£10	6	6	9⅜ — 10⅛ xd	..	5 18 5
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	£5	15	10†	12⅜ — 13½	..	5 11 1
Do. Pref.	£5	4½	4½	4⅜ — 5	..	4 10 0
Do. Deb.	100	4½	4½	99 —101	—1	4 9 0
India-Rubber, G. & T.	£10	7½	7½	11 — 12 xd	..	6 5 0
Do. Pref.	£10	5	5	9 — 9⅜ xd	..	5 2 7
Telegraph Construction	£12	20	5†	37 — 39	..	6 3 1
Do. Deb.	100	4	4	96 — 98 xd	+½	4 1 8
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	65 — 69	+3	5 16 0
Do. B 4 % Cum. Pref.	100	..	..	48 — 53	..	..

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	£10	4½	4½	6¼ — 6⅝	..	6 13 4
Do. 5 % Deb. Red.	Stock	5	5	98 — 85 xd	..	5 5 0
American Telep. & Teleg., Cap.	$100	8	8	124 —127 xd	..	6 6 0
Do. Collat. Trust	$1000	4	4	87 — 90 xd	..	4 9 0
Anglo-American Telegraph	£Stock	3	3	63 — 66	..	4 11 0
Do. 6 % Pref.	Do.	6	6	105½—106½	..	5 13 6
Do. Def.	Do.	30/-	..	24⅜ — 24⅝	..	6 0 7
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	£5	8	..	7 3/16 — 7 5/16	..	5 5 10
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	78 — 80 xd	..	5 0 0
Cuba Telegraph	£10	6	6†	8 — 9	..	6 13 4
Do. 10 % Pref.	£10	10	10	14½ — 15½	..	6 9 0
Direct Spanish Telegraph, Ord.	£5	4	4	3⅜ — 3⅝	..	5 6 8
Do. 10 % Cum. Pref.	£5	10	..	6⅜ — 7⅛	..	6 12 0
Direct United States Cable	£10	4	4†	6⅛ — 6⅜	..	5 18 6
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	96 —98 xd	..	4 11 10
Eastern Telegraph, Ord. Stock	Stock	7	7	124 —127	..	5 10 3
Do. 3½ % Pref. Stock	Do.	3½	3½	75— 77	..	4 10 11
Do. 4 % Mort. Deb.	Do.	4	4	94 — 96	..	4 8 4
Eastern Extension	£10	7	7	12 — 12½	..	5 12 0
Do. 4 % Deb.	Stock	4	4	94 — 96	..	4 3 4
Globe Telegraph and Trust	£10	6	6†	10⅜ — 11⅛	..	5 7 10
Do. 6 % Pref.	£10	6	6	11⅜ — 12½	..	4 18 0
Great Northern Telegraph	£10	20	5†	30½ — 32½	..	6 2 8
Indo-European Telegraph	£25	13	5†	57 — 59	..	5 10 2
Mackay Companies Common	$100	5	5	79 — 83	..	6 0 6
Do. 4 % Cum. Pref.	$100	4	4	64 — 68	..	5 17 8
Marconi's Wireless Telegraph	£1	20	20	3⅜ — 3½	+ 1/16	5 14 3
Do. 7 % Cum. Partic. Pref.	£1	17	..	2⅜ — 2⅝	+1/16	5 18 8
Monte Video Telephone, Ord.	£1	6	6	¾ — 1	..	6 0 0
Do. 5 % Pref.	£1	5	5	3/4 — 15/16	..	6 8 0
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	98 — 99	+ ½	4 11 0
Oriental Telep. and Elec.	£1	10	10†	1⅝ — 2	..	5 0 0
Do. 6 % Cum. Pref.	£1	6	6	1 3/16 — 1 5/16	..	5 1 1
Do. 4 % Red. Deb.	Stock	4	4	85 — 87 xd	..	4 12 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	96 — 98	—1	4 1 8
Reuter's	£10	10	10†	8⅜ — 9⅜	+ ½	10 5 2
Submarine Cables Trust	Cert.	6	6	122⅛ —125⅛	..	4 15 7
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	94 — 96 xd	..	4 13 9
United River Plate Telephone	£5	8	6†	6⅜ — 6⅞	..	5 16 5
Do. 5 % Cum. Pref.	£5	5	5	4⅝ — 5⅛xd	..	4 13 0
West Coast of America	£2½	2½	..	1 1/16 — 1 1/8	..	4 8 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	94 — 97	..	4 2 6
West India and Panama Teleg.	£10	1½	1½	2⅛ — 2⅜	..	5 0 0
Do. 6 % Cum. 1st Pref.	£10	6	6	9⅝ — 10⅜	..	5 17 0
Do. 6 % Cum. 2nd Pref.	£10	6	6	9 — 9⅝	..	6 6 4
Do. 5 % Debs.	100	5	5	96 — 98 xd	..	5 2 0
Western Telegraph, Ltd.	£10	7†	7	12⅜ — 13⅛xd	..	5 6 8
Do. 4 % Debs.	Stock	4	4	90 — 92 xd	..	4 7 0
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	92 — 95	..	4 14 9

* Unless otherwise stated all shares are fully paid. † Interim dividend. a Paid in deferred interest warrants.

Bank rate of Discount 5 per cent., October 2nd, 1913.

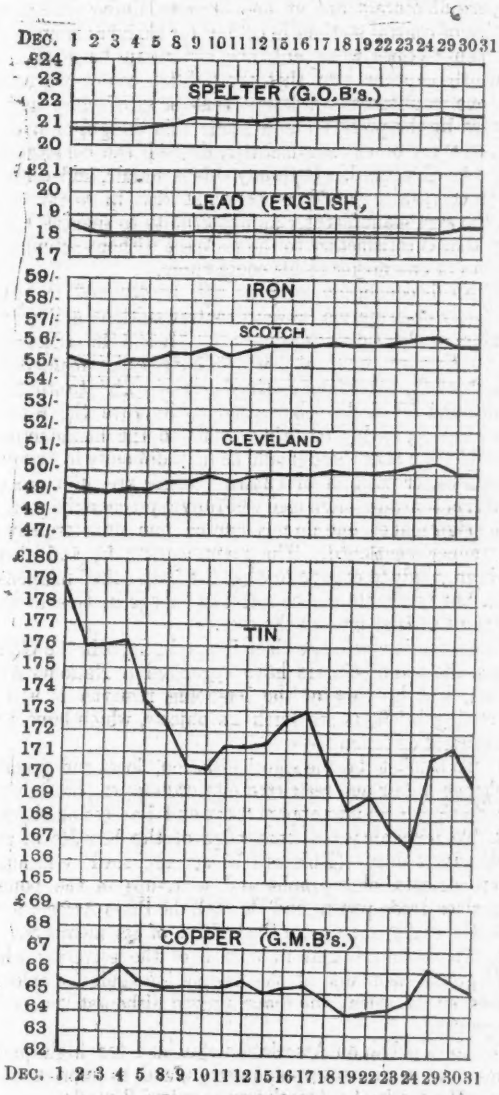
Electric Light Switching Competition.—Those who are interested in the manifold ways of controlling glow lamps by means of tumbler switches, and who wished to improve and afterwards test their knowledge of the subject, would be well advised to consult the issues of our contemporary *Electricity* during this month. This journal is holding a free competition which involves the working of an examination paper; and prizes and certificates will afterwards be awarded to successful competitors.

Works in Canada. — Newspaper reports state that Mr. A. F. Yarrow has purchased eight acres of land and the shipbuilding and repairing plant of Bullen Bros., at Esquimalt, for £60,000, to be a branch of the British firm, and to be known as Yarrows, Ltd.

Patent Application.—MR. F. H. TIDNAM has applied for restoration of Patent No. 4,030, of 1908, for "Improvements in Telegraph Poles."

METAL MARKET.

Fluctuations in December.



Factory Premises in 1913.—In the course of their report on factory and commercial property sales in 1913, MESSRS. LEOPOLD FARMER & SONS state that the sales and letting of factory property, wharves, land, &c., show far better results than was the case in 1912, the continued boom in trade in the industrial world having given a great impetus to the development of the new industries, and the consequent establishment of new works. . . It is difficult to say which branch of any particular manufacture more than any other has progressed in the year 1913. . . Great developments have taken place in . . . engineering, chemical, spinning, motor and rubber trades. The demand for ground floor works largely exceeds the supply, and if capitalists would erect factories and let them as an investment a very good return for their money would be assured, as firms of good standing would willingly pay 8 per cent. on the outlay as rental, and so use the capital in their own business to better advantage. The effects of the Patents and Designs Act are still well to the front, a sum amounting to about £2,000,000 having been expended in the acquiring of land, building of factories, and plant and machinery equipment, and the consequent employment of some thousands of workpeople. Foreign holders of English patents are still on the look-out for factory property to comply with the requirements of the Act, and several areas in and around London and the provinces have been developed in consequence of the establishment of important industries which give employment to thousands, and additional rates to local and other attendant authorities. The outlook ahead for further deals in factory property is good, as there is every likelihood of a continuance of prosperous activity in the industrial world.

SOME NOTES ON ELECTRIC SIGNS.

BY G. BASIL BARHAM, A.M.I.E.E.

THE subject of electric signs has recently been attracting considerable attention not only in this country but also in the United States, where signs are used, as everyone is aware, to a much larger extent than they are in England.

Comparatively few electrical contractors appear alive to the fact that the by-laws for the regulation of lamps, signs or other structures overhanging the public way, under the London Building Act, 1894, Sec. 164, made by the Building Acts Committee of the London County Council, deal exhaustively with the subject of electric signs, and whilst there is no doubt that manufacturers of these appliances are acquainted with the regulations, it is more than probable that there are many contractors who are unaware that there have been any recent enactments made regarding their use.

The by-laws are of sufficient importance to warrant their being dealt with at some length. It must be remembered, however, that they only apply to the district governed by the London County Council, and are not in force in the City of London itself, nor in any part outside the area of the Metropolitan Borough Councils.

The first is to the effect that after the date at which these by-laws come into force no person shall fix or fit any lamp or structure supporting or carrying a lamp, or retain any lamp or structure carrying it so as to overhang the footpath at a less height than 8 ft., or nearer to the roadway than 2 ft. 6 in. from the edge of the curb, or projecting more than 5 ft. from the wall or other part of the premises to which it is fixed.

After the date at which these by-laws come into operation no one shall fix any lamp which exceeds 3 ft. in any part when measured in any direction horizontally, including framework and ornaments, or which, including framework and ornaments, exceeds 5 ft. in height, or which weighs more than 84 lb., or retain any such lamp so fixed after such date so as to overhang the public way. Any lamp which may be fixed according to this by-law shall be provided with a second means of support, of sufficient strength to sustain safely the whole weight of the lamp against falling away from its support.

After these by-laws come into operation, no one shall fix any sign or structure supporting or carrying a sign, or retain any sign or structure supporting a sign, so as to overhang the public way so that any part of such sign or structure shall be at a less height than 8 ft. clear above the surface of the footway immediately under such sign or structure, or nearer to the carriage way than 2 ft. 6 in. from the outer edge of the curb or projecting more than 4 ft. from the wall or shop front of the premises or other support to which it is attached.

Further, if any such sign or structure shall extend more than 2 ft. (not including stays or support) along the face of the wall, shop front or support, then it shall not project more than 2 ft.

After these by-laws come into operation no one shall fix any sign or structure which exceeds 2 ft. 6 in. in height, or extends more than 6 ft. in any direction (not including stays or support) along the face of the wall or shop front of any premises, or retain any sign so fixed so as to overhang the public way.

A person shall not fix any lamp or sign until two clear days' notice, in writing, of his intention has been given to the local authority.

The County Council apparently does not wish to act in any arbitrary manner in connection with these by-laws, for it reserves the right, after consulting with the local authority in whose area the case may arise, to dispense with the observance of all or any of these by-laws.

It may be mentioned that any person who commits any offence against any of the foregoing by-laws will be liable to a penalty not exceeding £5, and a daily penalty of 40s. for every day during which such offence continues after conviction.

These by-laws do not apply to any balcony, shelter, covered way or other projection overhanging the public way not being a lamp, sign or structure within the meaning of

these by-laws which has been, or shall at any time hereafter, be duly sanctioned by the London County Council, under the London Building Acts, or any other statute in that behalf.

Nor do they apply to any lamp or structure supporting the same overhanging the public way, which may be fixed at not less than 7 ft. 6 in. clear above the surface of the footway, and so as not to project from the line of the window frame of the shop more than 3 ft., nor nearer the carriageway than 2 ft. 6 in. from the outer edge of the kerb, and which is solely for the purpose of illuminating such windows from without, the lamp itself not to exceed 36 in. in height, 24 in. in width parallel to the face of the building, and 24 in. in depth from front to back of lamp, including any ornamentation.

It will be evident from the above that electrical contractors, at any rate those in the area governed by the London County Council, will have to give careful consideration to every order for electric sign work which they receive, to make certain that they are not unwittingly infringing any of the new by-laws. But it must be admitted that the London County Council has not pressed unduly as regards its requirements, and there are few who will refuse to admit that some regulations relating to the fixing of electric and other signs were becoming desirable.

Turning from the contractor's side of the electric sign business to that of the manufacturer, it appears that a situation has arisen which deserves the earnest consideration of both manufacturer and retailer. Manufacturers are, it may be unwittingly, continually asked for sketches and designs for signs for both contractors and central-station men, frequently in cases where there is little or no prospect of business resulting. No maker objects to sending more or less complete drawings for electric signs suitable for business purposes when there is a fair prospect of an order being obtained. It is part of his work, and speculative though it may be, he regards it philosophically, and is quite prepared to run the risk of hearing that the design was unsuitable, or that the order has gone elsewhere. But there are limits, and in the words of one manufacturer published in a recent issue of "Signs of the Times," a great many new-business department managers of lighting companies seem to think that the way to keep busy is to determine in their minds that "Jones" ought to have an electric sign, and then go back to the office and write a circular letter which is sent to every sign manufacturer in the country giving the various details, and asking for sketches, photographs, &c., and when these sketches all arrive, it is possible that Jones will turn down the entire proposition on the first interview. The "new-business" man is aware of the fact that it does not cost him or his company a single dollar to try to wake up Jones, and in the meantime the manufacturer has contributed materially to the apparent activity.

It may be that there is a certain element of exaggeration in the letter quoted, but that there is a great deal of truth in it cannot be denied. Owing to the introduction of the high-efficiency metal-filament lamps central stations are compelled to make every effort to secure new business, but it must be admitted that it is not fair for them to saddle manufacturers with the whole of the expense connected therewith. In many ways the policy is short-sighted and not calculated to make for the best interests of the industry. Every maker penalised in that way is forced to look on the matter from a business point of view, and add the necessary percentage to the cost of those signs which he does sell. In this way the price is unduly inflated, and this affords an opening to those makers who make use of a rival illuminant. Commenting on the position, the *Electrical Review and Western Electrician* points out that in some of the larger central-station companies where electric-sign departments are maintained, preliminary sketches to be used primarily for stimulating business can be worked up by a central-station employé without the aid of the manufacturers. It seems, also, that electric-sign manufacturers could supply central stations with an assortment of designs of signs that have already been installed, covering the usual classes of sign prospects. These designs, of course, would only be used in preliminary soliciting to create an interest in electrical advertising and to gain, if possible, some idea of the requirements to be fulfilled.

When a *bona fide* prospect has been developed the sign manufacturers are certainly willing to furnish sketches and all necessary data, but here, again, a practice has developed that imposes a burden on the manufacturer, and consequently militates against the fullest development of the industry. Sign manufacturers are at one in complaining against the practice of central stations in calling for sketches from every sign manufacturer when only one order can be given. It frequently happens, also, that the lighting company receives from one manufacturer a design that is satisfactory and is accepted by the prospect, and sends this design, or a copy of it, to every other manufacturer, to see if the construction cannot be cheapened. Certainly this is unfair, and central-station companies should co-operate at least in so far as to give the sign manufacturer an opportunity to suggest something that is satisfactory to the prospect without submitting sketches of one maker to his competitors.

With this conclusion everyone will be disposed to agree, and better co-operation between central stations and manufacturers of electric signs would probably end the whole difficulty. Neither party appears to have quite realised the position of the other, and as the desire of both is to stimulate the demand for electric signs, and so improve the revenue of the station, with a resulting profit to the manufacturer, it would seem that there should be little difficulty in bringing about a better position of affairs. There are, of course, a number of central-station men who fully appreciate the position of the sign maker, and do not burden him unnecessarily in the manner mentioned. The manufacturer is, and always has been, ready to engage in what has been called missionary work, but he should not be asked to engage in this to such an extent as is at present the case.

In connection with the electric sign business in the United States, the manufacturers have organised a National Association, and in view of the foregoing remarks it will be interesting briefly to set forth its objects, which have been summarised as follows:—

1. To combat hostile sign legislation, local and general; to change unfair and restricted city ordinances pertaining to electric signs; and to oppose taxes and licences on signs.
2. To disseminate a knowledge of the benefits of electrical advertising. (This will be accomplished by means of advertisements, photographs and write-ups in the popular magazines, trade papers, and through the Press Associations.)
3. Generally to promote the welfare of its members.
4. To obtain a bureau in charge of the secretary which shall guard members of the Association against employing agents or salesmen who have proved dishonest with other companies.
5. To establish an Association standard for high quality of material, workmanship and design, and to impress on the public the merit of "Association standard" goods.
6. To combat the growing evil of stealing sketches and matching prices.

Few will be disposed to cavil at any of these suggestions, and it might well be that some similar organisation in this country would be of lasting benefit to all concerned.

Proposed Liverpool Tube Railways.—A scheme is on foot with a view to solving the traffic problem in Liverpool and district. On behalf of a wealthy American syndicate, the Liverpool Corporation and the neighbouring municipalities, the Mersey Tunnel Railway Co., the Overhead Railway Co. and other interests are being approached with a view to ascertaining what attitude they will adopt towards an extensive scheme for underground railway connection. Though the matter has not yet been "formally" presented to the authorities concerned, the proposal is, in broad outline, that an offer might be made to purchase the Mersey Railway on terms advantageous to all shareholders who might consent to sell their holding. Branch lines connected with the Central (Low Level) Station would be constructed so as to serve a wide area on both the Lancashire and Cheshire sides. As an important link there would be constructed a circular line connecting at low level the L. & N.-W., the Cheshire Lines and the Lancashire and Yorkshire termini. On the Cheshire side of the Mersey, a complete electrification of existing and proposed Wirral Peninsular Lines would be promised if terms of purchase or leasing of the former could be arranged. The whole of Wallasey would gain an electric railway service, while by means of two loop lines West Kirby and Neston would be reached. An electrical extension of the present line from Rock Ferry to Chester would, no doubt, be a natural further development.

TRADE STATISTICS OF CANADA.

The following figures, showing the imports into and exports from Canada of electrical and similar materials during the year ended March 31st, 1913, are taken from the recently issued trade statistics. Figures for the year 1911-12 are given for purposes of comparison, and notes of any increases or decreases have been added :—

	1911-12. Dollars.	1912-13. Dollars.	Inc. or dec. Dollars.
Brass wire, plain.—			
From United Kingdom...	7,000	7,000	—
,, United States ...	31,000	67,000	+ 36,000
Total ...	38,000	74,000	+ 36,000
Railway passenger cars.—			
From United States ...	208,000	303,000	+ 95,000
Tram or horse cars.—			
From United States ...	5,000	2,000	— 3,000
Copper wire, plain, tinned or plated—			
From United Kingdom...	4,000	1,000	— 3,000
,, United States ...	72,000	105,000	+ 33,000
Total ...	76,000	106,000	+ 30,000
Electric light carbons and carbon points.—			
From United Kingdom...	8,000	4,000	— 4,000
,, Germany ...	17,000	24,000	+ 7,000
,, United States ...	29,000	41,000	+ 12,000
,, Other countries ...	2,000	2,000	—
Total ...	56,000	71,000	+ 15,000
Electric apparatus not mentioned—insulators, batteries, telegraph and telephone instruments.—			
From United Kingdom...	544,000	987,000	+ 443,000
,, Austria	6,000	2,000	— 4,000
,, France	8,000	13,000	+ 5,000
,, Germany	29,000	77,000	+ 48,000
,, Sweden	65,000	50,000	— 15,000
,, United States ...	3,975,000	5,849,000	+1,874,000
,, Switzerland ...	2,000	2,000	—
,, Other countries ...	6,000	6,000	+ 10,000
Total ...	4,635,000	6,996,000	+2,361,000
Incandescent lamp bulbs, etc.—			
From Austria	17,000	25,000	+ 8,000
,, United States ...	99,000	111,000	+ 12,000
,, Other countries ...	5,000	10,000	+ 5,000
Total ...	121,000	146,000	+ 25,000
Electric motors, generators, dynamos and sockets.—			
From United Kingdom...	76,000	193,000	+ 117,000
,, France	2,000	4,000	+ 2,000
,, Sweden	30,000	68,000	+ 38,000
,, United States ...	871,000	1,313,000	+ 442,000
,, Other countries ...	4,000	16,000	+ 2,000
Total ...	983,000	1,584,000	+ 601,000
Lamp chimneys, glass shades and globes.—			
From United Kingdom...	4,000	8,000	+ 4,000
,, Austria	13,000	18,000	+ 5,000
,, Germany	30,000	35,000	+ 5,000
,, United States ...	275,000	361,000	+ 86,000
,, Other countries ...	1,000	3,000	+ 2,000
Total ...	323,000	425,000	+ 102,000
Rubber belting.—			
From United Kingdom...	36,000	15,000	— 21,000
,, United States ...	47,000	109,000	+ 62,000
Total ...	83,000	124,000	+ 41,000
Manufacture of india-rubber and gutta-percha, except clothing and similar goods.—			
From United Kingdom...	155,000	218,000	+ 63,000
,, Austria	8,000	12,000	+ 4,000
,, France	4,000	8,000	+ 4,000
,, Germany	48,000	60,000	+ 12,000
,, United States ...	645,000	753,000	+ 108,000
,, Other countries ...	1,000	—	— 1,000
Total ...	861,000	1,051,000	+ 190,000
Locomotives for railways.—			
From United Kingdom...	8,000	2,000	— 6,000
,, United States ...	407,000	784,000	+ 377,000
,, Other countries ...	—	1,000	+ 1,000
Total ...	415,000	787,000	+ 372,000
Gasoline engines.—			
From United Kingdom...	189,000	107,000	— 82,000
,, United States ...	1,935,000	3,301,000	+1,366,000
,, Other countries ...	15,000	6,000	— 9,000
Total ...	2,139,000	3,414,000	+1,275,000
Steam engines.—			
From United Kingdom...	47,000	117,000	+ 70,000
,, United States ...	230,000	459,000	+ 229,000
Total ...	277,000	576,000	+ 299,000
Boilers, Steam.—			
From United Kingdom...	74,000	74,000	—
,, United States ...	162,000	323,000	+ 161,000
Total ...	236,000	397,000	+ 161,000
All machinery not mentioned, except sewing machines, textile machinery, printing machinery, &c.—			
From United Kingdom...	1,713,000	2,015,000	+ 302,000
,, France	6,000	7,000	+ 1,000
,, Germany	203,000	209,000	+ 6,000
,, United States ...	13,331,000	17,485,000	+4,154,000
,, Other countries ...	111,000	73,000	— 38,000
Total ...	15,364,000	19,789,000	+4,425,000
Iron and steel wire, single or several, covered with cotton, linen, silk, rubber, or other material, including cables so covered.—			
From United Kingdom...	229,000	434,000	+ 205,000
,, United States ...	426,000	774,000	+ 348,000
,, Other countries ...	8,000	12,000	+ 4,000
Total ...	663,000	1,220,000	+ 557,000
Iron and steel wire not mentioned (except fencing wire).—			
From United Kingdom...	13,000	16,000	+ 3,000
,, Germany	49,000	6,000	— 43,000
,, United States ...	218,000	301,000	+ 83,000
,, Other countries ...	8,000	1,000	— 7,000
Total ...	288,000	324,000	+ 36,000
Lighting fixtures of metal, including electric light fixtures of metal.—			
From United Kingdom...	34,000	51,000	+ 17,000
,, Austria	3,000	4,000	+ 1,000
,, United States ...	562,000	709,000	+ 147,000
,, Other countries ...	10,000	17,000	+ 7,000
Total ...	609,000	781,000	+ 172,000
Asbestos manufactures.—			
From United Kingdom...	43,000	44,000	+ 1,000
,, United States ...	298,000	443,000	+ 145,000
,, Other countries ...	9,000	10,000	+ 1,000
Total ...	350,000	497,000	+ 147,000
Plumbago, ground and manufactured.—			
From United Kingdom...	4,000	8,000	+ 4,000
,, United States ...	35,000	50,000	+ 15,000
Total ...	39,000	58,000	+ 19,000
EXPORTS.			
Mica.—			
To United Kingdom ...	40,000	37,000	— 3,000
,, United States ...	218,000	282,000	+ 64,000
,, Other countries ...	—	2,000	+ 2,000
Total ...	258,000	321,000	+ 63,000
Electrical apparatus.—			
To United Kingdom ...	16,000	12,000	— 4,000
,, Newfoundland ...	5,000	9,000	+ 4,000
,, United States ...	110,000	188,000	+ 78,000
,, Other countries ...	7,000	7,000	—
Total ...	138,000	216,000	+ 78,000
Machinery.—			
To United Kingdom ...	70,000	66,000	— 4,000
,, Newfoundland ...	35,000	112,000	+ 77,000
,, New Zealand ...	3,000	5,000	+ 2,000
,, Argentina	33,000	25,000	— 8,000
,, France	10,000	20,000	+ 10,000
,, United States ...	461,000	806,000	+ 345,000
,, Other countries ...	75,000	68,000	— 7,000
Total ...	687,000	1,102,000	+ 415,000

THE ELECTRICITY SUPPLY OF LARGE CITIES.

By PROF. G. KLINGENBERG, Dr. Ph.

(*Concluded from page* 39.)

THE foregoing calculations were carried out on the assumption that a new power station would be erected in the vicinity of the city supply area. The question that remains to be examined is whether greater advantages could be obtained by erecting the new power station at coal mines, and transmitting the energy to the city by long-distance transmission lines. A general investigation does not appear to indicate promising results.

TABLE VI.

c.s. = centishillings.

	Before reconstruction.	*After reconstruction.*
Available capacity at sub-stations or outgoing feeders...	126,000 KW.	126,000 KW.
Number of power stations ...	25	4
Installed output of new power station	—	83,000 KW.
Installed output of old power stations	—	46,000 KW.
Feeder cable losses per KW.-hour sold	—	0·041 KW.-hour
Total efficiency of transmission-system = KW.-hours sold ÷ KW.-hours generated	0·788	0·788
Total load factor of power stations	24·9 per cent.	24·9 per cent.
Total reserve factor	1·61	1·25
Total utility factor	0·122	0·156
Energy sold per kilowatt installed and per year	1,069 KW.-hours	1,370 KW.-hours
Energy supplied from old stations, eight months' service, n = 0·156	—	333 KW.-hours
ditto. from the new power station	—	1,037 KW.-hours
Utility factor of old power station, n	—	0·156
ditto. of large power station, n	—	0·186
Working costs per KW.-hour supplied to low-tension network :—		
New power station (incl. 10 per cent. capital charge) ...	—	4·878 c.s.
Old power stations (excl. capital charge)	—	3·820 ,,
Capital charges on the 25 old power stations (8 per cent. as hitherto)	—	3·874 ,,
Average price per KW.-hour supplied	9·440 c.s.	8·510 ,,
Low-tension network losses per KW.-hour sold...	0·268-KW.-hour	0·229-KW.-hour
Costs for losses	2·480 c.s.	1·940 c.s.
Working costs (incl. capital charge, 8 per cent. as hitherto)	7·610 c.s.	5·966 c.s.
Total costs (incl. capital charges) per KW.-hour sold	19·530 c.s.	16·416 c.s.
Capital	183,830,000s.	218,010,000s.
Energy sold per annum, KW.-hrs.	135,000,000	172,000,000
Annual revenue	26,400,000s.	33,600,000s.
,, expenses	26,400,000s.	28,400,000s.
Available surplus	—	5,200,000s.

With regard to the constants, I have taken normal values adapted as far as possible to London conditions.

Basis for the Comparison of Local and Distant Power Stations.—Difference in price of coal delivered free at bunkers, 3s. 6d. per ton; price of coal free at bunkers, distant power station, 7s. per ton. Installation costs of power station—At the mine, 170s. per KW.; near the city, 210s. per KW.; max. output at end of line, 80,000 KW.

There will be no essential alterations in the results of the comparison if, in place of 80,000 KW., two or three times this value is taken, as this merely entails an alteration of the absolute value while the relative figures remain approximately the same.

For the long-distance transmission I have selected three-phase current at 50 cycles, with a line pressure of 100,000 volts, both for overhead and cable transmission.

I would propose purchasing a strip of land 15 metres wide for each line of masts at an average price of 300s. per ha. (= 2·47 acres). It is necessary to provide two rows of masts, to allow for repairs, whereas with single-phase cables one cable per circuit suffices as a reserve, provided it can be put into commission without interrupting the supply. The main step-down station must be placed on the outskirts of the city, unless 100,000-volt cables are used for taking the energy into the city.

The comparison includes the plants up to the feeding points of the 20,000-volt ring mains (see fig. 4, p. 39), as from this point the systems and methods of working are the same for all cases. The distance from the mines is taken as 100 km., 150 km., 200 km. and 250 km. respectively. The costs then work out approximately as follows :—

A. *Local Power Station.*

1. Power station : 83,000 KW.	...	17,430,000s.
2. Feeder cable : 20,000-volt	...	5,000,000s.
		22,000,000s.

B. *Distant Power Station with Overhead Transmission. Installation Cost in Shillings.*

Distance.	Power station.	Overhead transmission.	Main step-down station.	Feeder cable.	Total.
100 KM.	15,640,000	4,700,000	1,700,000	5,000,000	27,040,000
150 ,,	15,980,000	7,050,000	1,700,000	5,000,000	29,730,000
200 ,,	16,150,000	9,400,000	1,700,000	5,000,000	32,250,000
250 ,,	16,320,000	11,750,000	1,700,000	5,000,000	34,770,000

Distant Power Station with Cable Transmission. Installation Cost in Shillings.

Distance.	Power station.	Cable transmission.	Main step-down station.	Total.
100 KM. ...	14,620,000	10,470,000	1,700,000	26,790,000
150 ,, ...	14,960,000	15,915,000	1,700,000	32,575,000
200 ,, ...	15,300,000	21,580,000	1,700,000	38,580,000
250 ,, ...	15,640,000	27,400,000	1,700,000	44,740,000

The results of the comparison for some of the foregoing cases have been tabulated in fig. 5, which shows the comparison between a local power station and a distant power station with overhead transmission, the values including 10 per cent. for the capital charges on the power station and sub-stations, and 8 per cent. for the overhead transmission line and cable. The calculations prove that the working costs with cable transmission are higher than with overhead transmission at low utility factors, and that with the utilisation of about 50 per cent. they are practically equal. The curves

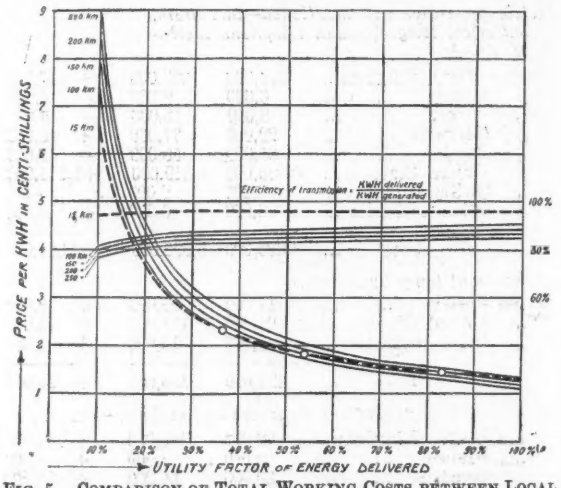


FIG. 5.—COMPARISON OF TOTAL WORKING COSTS BETWEEN LOCAL AND DISTANT POWER STATIONS, WITH OVERHEAD LINE TRANSMISSION.

further show that under the assumptions made, the local station can be operated more cheaply than the distant station. The operating costs of the former, however, rise towards those of the distant station, and from a utility factor of 30 per cent. upwards, exceed them in succession at 100, 150, 200 and 250 km. transmission distances.

The comparison has shown that under certain conditions, namely, with coal freight at 3s. 6d. per ton and with a normal utility factor, it would be cheaper to operate a power station situated near the city than one at the coal mines. I do not, however, look upon the difference as sufficient to decide so important a matter as the locality of the power station. There are other considerations of a more general nature that have a considerable bearing on the point at issue.

A Report on Companies.—From the annual report mentioned in our leaderette last week, it appears that two applications for leave to pay interest out of capital during construction, under Sec. 91, were made to the Board of Trade during 1912. In one case the application was sanctioned, and in the other case it was withdrawn. It is somewhat surprising that the powers vested in the Board of Trade under Sec. 112 of the Act of 1908, to appoint an auditor, if an appointment of auditors is not made at the annual general meeting of the company, had to be exercised in seven cases during the year. After allowing for a net increase of 2,926 companies during the year, there were some 52,000 companies on the register for England and Wales. Proceedings had to be taken by the Board in some cases to enforce returns being made to the Registrar of Joint Stock Companies, and against liquidators to enforce the filing of accounts, and in three cases to enforce the payment of undistributed funds into the companies' liquidation account.

THE EMPLOYMENT OF POWER IN H.M. POST OFFICE.

BY H. C. GUNTON, M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *at Manchester, December 16th, and London, December 18th, 1913.*)

UNTIL recently the energy for power and lighting in London and seven of the larger provincial towns has been supplied from small power houses situated in the basements of the Post Office buildings, and some of these stations have been in existence for about 20 years. In the metropolitan area two of these old power houses have recently been replaced by the new electric power system, which at present includes a main generating station on the south side of the river, near Blackfriars Bridge, and three sub-stations in basements at King Edward Building, G.P.O. West, and Carter Lane.*

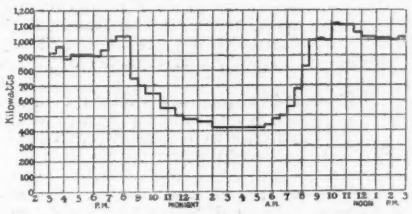
Electric power is generated as three-phase alternating current, with a frequency of 50 periods per second, and at a pressure of 6,600 volts, and transmitted at this pressure to the three sub-stations, where it is transformed down for the supply of the lighting and power circuits.

At G.P.O. West sub-station the three-phase supply is converted to continuous current at 440 and 220 volts, in conjunction with a storage battery; in the event of temporary interruption to the E.H.T. supply from the power house, the battery will for a considerable time not only maintain the supply to the continuous-current circuits, but will also, by running the motor converters reversed, automatically maintain the pressure on the E.H.T. bus-bars at the other two sub-stations, and so enable the transformers to maintain the alternating current supply.

The normal full-load capacity of the main generating plant, including spares at the power house, is 2,500 KW.

Although the present output is small, the extremely favourable character of the load curve (fig. 1) has enabled a supply of energy to be given for all purposes at an inclusive cost of about 1½d. per unit delivered.

As regards the provincial stations, arrangements have been made in several instances to change over to the local municipal supplies.



Load factor = 73·4 per cent. Running plant load factor = 80·1 per cent. Average power factor = 0·98 lagging.

FIG. 1.—DAILY LOAD CURVE (APRIL 25TH, 1913) OF G.P.O. POWER STATION AT BLACKFRIARS.

In some instances, to obtain a low price, a battery has been installed to improve the load factor, at the same time providing a standby against emergency.

Pneumatic tubes, which have been used in London since 1871, have since been installed in almost every telegraph office of appreciable size in the kingdom. Usually, electrically-driven pumps are employed, with automatic regulation, electrically-operated valves devised by the P.O. staff, having given the most satisfactory results. In some cases the air drawn from the vacuum mains is compressed for the pressure service, as, *e.g.*, at the G.P.O.; when this is done, precautions have to be taken against drawing in gas through leaky street tubes. Rotary blowers serve for the house tube systems. About 5 to 5½ H.P. is required to work a 2¼-in. tube 1 mile long continuously at 10 lb. pressure, the time occupied in the transit of the carrier being 2¼-2½ minutes. Vacuum working at 7 lb. below atmosphere requires less power in the ratio of 1·83 : 1. Tubes are in use in London up to 4,180 yards in length, 3 in. in diameter. The power consumed in maintaining the passage of carriers at intervals of 5 to 10 sec. in a 1½-in. tube system of a total length of 650 ft. is only ½ KW.

Pneumatic power has recently been employed in a trunk telephone exchange for distributing, between certain points in the exchange, the tickets on which are entered particulars of the trunk connections required. Instead, however, of using tubes of circular section and carriers, the tubes are of rectangular section 2⅜ in. × ⅜ in. and the tickets are propelled through them by means of a folded end at right angles to the remainder of the ticket, which practically serves as a sail. The tickets are conveyed from various operators to a distributing centre by vacuum, and are thence dispatched by pressure to other operators; at the distributing centre the tickets are discharged without destroying the vacuum, by means of two electrically-driven rollers which, except during the passage of the ticket, are kept in contact by springs on their axles. The tickets are also inserted in the vacuum tube by means of an arrangement which reduces the opening to the atmosphere to a minimum. The dispatch from the distributing centre is effected by placing the ticket in a receptacle and afterwards applying the pressure by means of a valve actuated by a plunger which also lights a signal lamp. The ticket on being discharged strikes a lever, breaking a contact which has the effect of de-energising the electromagnet in connection with the pressure valve, and so cuts off the pressure from that particular tube and extinguishes the lamp.

The P.O. Engineering Department has installed and maintains 207 electric lifts of various types, D.C. and A.C., three, two and one-phase. The cost of maintenance of electric and hydraulic lifts is taken to be about the same. The possibility of accident is reduced to a minimum with modern electric lifts, and there has not been a single fatal accident with an electric lift installed by the P.O. By proper adjustment of the controller, material economy in time

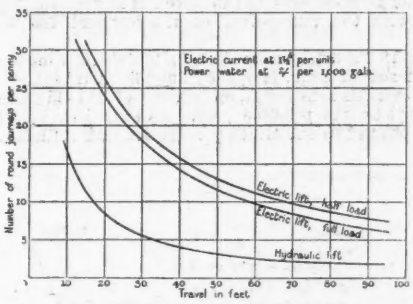

Electric current at 1½d. per unit.
Power water at 5/- per 1,000 gals.
Number of round journeys per annum
Electric lift, half load
Electric lift, full load
Hydraulic lift
Travel in feet.

FIG. 2.—COMPARISON BETWEEN ELECTRIC AND HYDRAULIC LIFTS OF 20-CWT. CAPACITY AND SPEED OF 200 FT. PER MINUTE. ELECTRIC SUPPLY THREE-PHASE 50 ~ 440 VOLTS.

and energy consumption can be effected. Fig. 2 shows a comparison between the costs of electric and hydraulic lifts, and fig. 3 shows the annual cost with reference to the number of round journeys per annum. The curves show the critical number of journeys per annum, for which the annual charges, inclusive of all costs, are the same for both types of lift, under different conditions of travel.

In the sorting offices in the larger postal centres electrically-driven ropeways, band conveyors, stamping machines, &c., are employed, and experiments have recently been made with a view

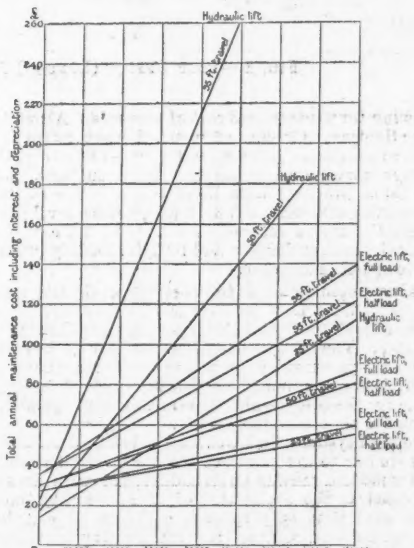


FIG. 3.—COMPARISON BETWEEN ELECTRIC AND HYDRAULIC LIFTS; INTEREST AND DEPRECIATION, 6 PER CENT.

to the mechanical transport of correspondence practically right through an office. Trials made at Liverpool indicate that a substantial saving of time will be effected. All the apparatus is electrically driven. In the telegraph instrument rooms at Birmingham an experimental installation of mechanical selective conveyors for telegram forms has been fitted up, with electrical driving.

The Post Office engineers have some 600 installations of heating plant to maintain, as well as all the mechanical ventilating systems. In telephone exchange switch rooms, where the high switchboards interfere with the natural circulation of the air, most satisfactory results have been obtained by installing suspended fans of the revolving type between the switchboards to circulate the air, in addition to fans in the windows for the extraction of air. In one particular case where natural ventilation is difficult, an ozone plant has been installed, with successful results.

* The installation was fully described in the ELECTRICAL REVIEW, November 18th and 25th, 1910.

Several types of machines for cleaning mail bags have been tried, the most satisfactory results being obtained with the type installed at the King Edward building, which is driven by an electric motor. The charge of bags is rendered completely clean in about 20 minutes, the total capacity of the plant being about 400 bags per hour.

A large amount of plant is in use in connection with central battery telephone exchanges, motor-generators and accumulators being almost exclusively used for this purpose. The generators are specially designed to give silent working when supplying the telephone-exchange circuits direct without any battery in circuit. Their chief features are ring-wound armatures with a large number of commutator segments, uniform distribution of the field, good balancing both mechanically and electrically, good commutator surface and a special type of high-conductivity brushes; large choke coils of special design are also used in conjunction with the machines, which are built in sizes from 1 to 40 KW. Upwards of 40 exchanges had to be equipped very rapidly in connection with the taking-over of the National Telephone Co.'s system.

In 1912-13 850 offices were electrically lighted, using the equivalent in terms of 8-C.P. lamps of 380,439 metallic-filament and 20,345 carbon-filament lamps, an increase of 258 offices and 78,609 8-C.P. lamps on the previous year. An annual saving of £8,000 has been effected by substituting metal for carbon-filament lamps, after allowing for the increased cost of renewals. About 4,300 KW. is used for lighting. Clusters of metal-filament lamps in fittings with opalescent shades have proved very satisfactory, the walls and ceilings having dull white or cream surfaces, and large windows being provided with light blinds. For sorting tables 2-3 foot-candles are necessary, 3 ft. above floor level; somewhat less illumination serves for instrument rooms, 1-2 c.-ft. for offices and trunk telephone exchanges, and 1-1·5 for loading platforms and ordinary telephone exchanges.

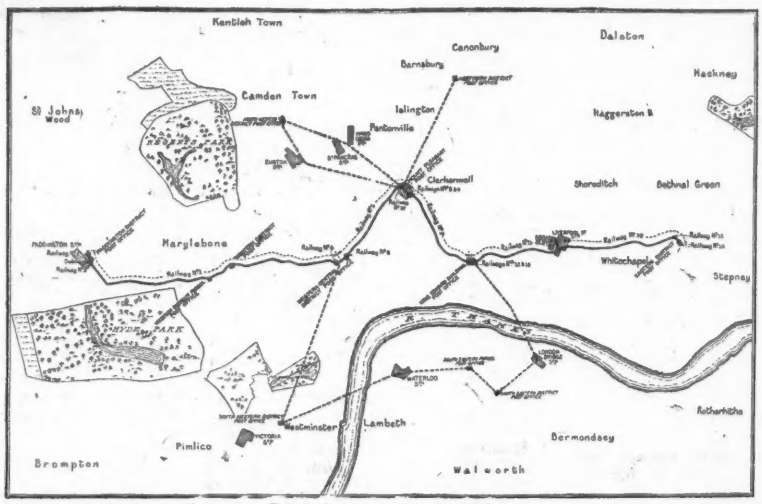


FIG. 4.—POST OFFICE (LONDON) RAILWAY.

Powers have been obtained to construct an electric railway for postal purposes from East to West London, as shown in full lines in the map (fig. 4), the dotted lines showing the ultimate extensions contemplated. The railway will consist of two tracks each of 2-ft. gauge, in a single tunnel 9 ft. in diameter. Mr. Dalrymple Hay is responsible for the tunnelling, and the Engineer-in-Chief of the Post Office for the equipment. The trains will be operated without drivers, on the remote-control system.

The proposed system of control may be briefly described as being generally similar to the power-operated point and signal systems adopted for modern railway undertakings, but with the signal element replaced by the application of current to the track. It is considered that it is only by such a system of complete interlocking that a remote-control electrical railway of this scope can be safely operated

With a view to reducing human labour and the delays connected with double handling, trials are at present being made with an electric truck equipped with an Edison battery (see ELECTRICAL REVIEW, Vol. 73, p. 342). This truck, which weighs only about 25 cwt. including a load of 10 cwt., is intended for use more particularly at offices that are in close proximity to railway stations. The control is sufficiently safe and flexible to meet the conditions of a crowded platform, while slopes as steep as 1 in 10 can be negotiated.

Trials of the truck, which is equipped with 42 B4 cells, have been carried out and the following results have been obtained:—

Voltage before run (half battery)	30 volts
Voltage after run (half battery)	20 ,,
Total number of journeys	160 ,,
No. of miles	25 ,,
No. of units used for charging	7·3 ,,
No. of watt-hours per ton-mile	225 ,,

Experiments are also being made with electrically-equipped vans for collecting purposes.

DISCUSSION AT LONDON.

MAJOR O'MEARA, in opening the London discussion, referred to the field of unskilled labour in transportation, with which the paper dealt; much of the plant was not really new, such as might be installed to start now, such as, for instance, the pneumatic tubes, which were rather slow. He complimented the author on the sortation system at the G.P.O.

MR. C. H. WORDINGHAM asked for information on the subject of standardisation, the working of the battery sub-station, lifts and fans employed. He also inquired as to the effect of ozone apparatus.

MR. W. SLINGO referred to the wide sphere of engineering covered by the Post Office administration. The proposed P.O. tube railway would certainly be a remunerative undertaking, otherwise the scheme would not have been proposed. The Post Office did not manufacture anything which it could get made for it; one machine was made and proved, and definite specifications were then issued for it. Cable makers were now carrying out complete contracts for making and laying, and he hoped the results would justify them in contracting for the laying, which used to be done by the P.O. staff.

MR. J. S. HIGHFIELD said it would appear that the cost of electric supply must be a minor proportion of the total cost of P.O. service, and that security was of more importance than cost, in which case isolated plants were really safer than the present arrangement of a distant generating station, with which the battery was the only safeguard.

MR. PERKINS said the Eastern Telegraph Co. had recently leased from the P.O. some 4½ miles of pneumatic tubes, and while these worked very well, it was found that occasionally the observation window in the valve was broken and the air was then lost for some time; the switch also cut the felt of the carriers. The introduction of band carriers for telegrams had greatly facilitated their work.

MR. ROGER SMITH was interested in the figures for electric and hydraulic lifts, which would only be obtained from extended experience. The conveyor was the only lifting machine giving about 100 per cent. load factor (the power did not vary much whether loaded or not), and it should be supplied at a much cheaper rate than was usual. Regarding electric trucks, the great difficulty was to charge them on a commercial circuit. What one wanted was for the ordinary user to be able to plug his cells on to a commercial circuit for any odd quarter of an hour. The batteries were generally some odd voltage, such as 60 or 40.

Another speaker criticised the air system for the pneumatic tubes. The fixed lights and low candle-power employed in lighting seemed awkward, and he thought hydraulic power was more reliable and equally as applicable as electric.

MR. GUNTON, in the course of an extended reply, said efforts were being made to standardise as far as possible. One speaker had asked about electric cooking, and he thought they might make a case for it if the price of energy were lower, say ¼d. per unit. Extractor type fans were employed in conjunction with radiators for the ventilation system. The P.O. had been forced to give up the small basement stations referred to by Mr. Highfield.

DISCUSSION AT MANCHESTER.

MR. W. J. MEDLYN said that condensation in pneumatic tubes was a serious difficulty, and had been encountered in a Liverpool street tube where the air was taken in at a temperature of 60° to 70° F. Condensation took place causing the messages and carriers to become damp, and it appeared that the use of air at a much lower temperature should be adopted. The presence of gas in the pneumatic air containers in Liverpool had been traced to a leaky gas pipe in close proximity to a leak in the pneumatic street tube. In telephone exchanges in the South Lancashire district alone there were installations of accumulators varying in capacity from 40 to 6,000 ampere-hours, and absorbing about 200,000 units annually for charging purposes. This consumption was likely to be considerably increased when the conversion of existing magneto exchanges to C B. working was carried out.

MR. G. H. VAUGHAN referred to the inconvenience caused by condensation in pneumatic tubes, and cited the case of a pneumatic ticket distributor installed in the London trunk exchange. In order to ensure satisfactory working, it was necessary that the tickets, after being folded in a particular way, should be rigid, this rigidity being obtained by drying in an electric oven. In order to eliminate condensation in the rectangular delivery tube, the speaker had suggested the use of calcium chloride filter bags, which device, he understood, was now under consideration.

PROF. E. W. MARCHANT, referring to the author's statement regarding improved efficiency due to improvement in controllers, said that in the case of a motor with constant flux per pole, and running on constant-pressure mains, it would not matter how the current was varied during the process of acceleration, the total energy taken from the mains for accelerating the motor would be constant, but the total quantity of electricity used during the period of acceleration would be greater the longer the period of acceleration. The more rapid the acceleration the less the waste of power.

He suggested the use of the term "Electric battery truck," instead of "electric truck," as in the paper.

The AUTHOR, in reply, said that on account of condensation trouble, pneumatic tubes for street work were carried out in lead, and, for indoor work, in brass. Experiments were being carried out along the lines indicated by Mr. Vaughan.

ELECTRICITY SUPPLY STATISTICS FOR GERMANY.

THE considerable progress which is being made in the extension of the electricity supply business in Germany, is evidenced by the statistics which are collected by the Verband Deutscher Elektrotechniker, and published in alternate years, those for the two years ended with April 1st, 1913, having just been issued by the firm of Julius Springer, of Berlin. It should first be explained that the information does not apply to power stations which solely serve the purpose of furnishing electrical energy for the operation of railways and tramways, or to stations which supply to blocks of buildings or to individual installations (factory or ironworks' stations), unless they also deliver energy for sale to the public. With these reservations, the statistics deal with all the stations throughout the country which are concerned with meeting the public requirements in regard to lighting, cooking and heating, and power purposes.

The increase in the number of public stations in recent years has been surprisingly large, although many of them are of comparatively small capacity, as will subsequently be shown. For instance, on April 1st, 1909, the number was 1,978; on April 1st, 1911, the number had advanced to 2,526, and on April 1st, 1913, it had further risen to 4,040, so that the stations have more than doubled in a period of four years. The figures also represent an average of nearly 15 new stations per week in the past two years, or about two new works opened daily. The appended table indicates the development of the capacity of the works, including generators and accumulators, in the same term of years on April 1st in each case:—

	Capacity of all works combined.	Average capacity per station.
1909	1,161,609 KW.	587 KW.
1911	1,466,418 KW.	580 KW.
1913	2,095,666 KW.	519 KW.

The reduction in the average capacity of the stations, which had always increased in former years, is attributed to the large expansion in the number of new stations, which nearly always commence on a small scale. But the determining factor in forming an opinion of the development of electricity supply is held to be less in the average capacity of the stations than in the total capacity of the large works capable of dealing with 5,000 KW. This class of works numbered 40 in 1909, and had a combined capacity of 617,672 KW.; in 1911 the number had risen to 53 of a total of 816,746 KW., and in 1913 to 103 of a total of 1,560,752 KW. The proportion which these bore to the total capacity of all the stations was 53·2 per cent. in 1909, 55·7 per cent. in 1911, and 74·5 per cent. 1913, whilst the last mentioned only represented 2·6 per cent. of the total number of stations throughout the country. The principal position is occupied by the Berlin Electricity Works with a capacity of 193,000 KW.; the second place is held by the Dusseldorf Reisholz Works with 65,000 KW., and the third by the Upper Silesian Electricity Works at Gleiwitz.

Coming to consider the capacity of the connections, the statistics show that the total, as represented by lamps, motors, &c., amounted to 1,860,860 KW. in 1909, 2,465,976 KW. in 1911, and 3,725,769 KW. in 1913. As the capacity of the connections has advanced to a greater extent than the increase in the capacity of the stations in the past four years, the conclusion is reached that consumers are utilising their installations in a larger measure. It is now of some interest to inquire as to the division of the connections between the lighting and power supply, the latter including stationary and tramway motors and the slowly growing use of cooking and heating apparatus. On these points the statistics furnish the accompanying figures:—

	Connections for lighting.	Connections for power.
1909	40·7 per cent.	59·3 per cent.
1911	38·2 ,,	61·8 ,,
1913	35·8 ,,	64·2 ,,

It will be observed from the course of the percentages in the four years that the connections for lighting was relatively declining as compared with the power supply business. The number of localities where public supply is in operation, was 4,700 in round figures in 1909, 11,000 in 1911, and 17,500 in 1913.

It is impossible to state definitely the actual amount of capital invested in the supply works, as the information on the question is incomplete owing to the failure of a number of works to furnish the particulars, but an estimate for the purpose has been prepared. If, for instance, a sum of £60 is taken as the average capital invested per KW. capacity of the station, and as the total capacity of all stations was 2,100,000 KW. on April 1st, 1913, the total capital investment will be found to work out at £126,000,000, excluding the installations on consumers' premises. It is assumed from the development in public supply business that from 4 to 5 per cent. of the increase in the national wealth has found employment in this particular branch of the electrical industry in the past four years.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

MOZAMBIQUE.—The Board of Trade have received information as to a proposed revision of the tariff on goods imported into Mozambique. Goods not specially mentioned in the tariff (no electrical goods are mentioned separately) are to be dutiable under this proposed tariff at the rate of 10 per cent. *ad valorem*, in place of the rate of 3 per cent. *ad valorem* formerly levied. In addition, it is proposed to maintain the municipal contribution of 25 per cent. of the amount levied under the ordinary tariff, and other contributions which amount to about 4½ per cent. *ad valorem*.

The *ad valorem* duty for imports will be calculated on the value of the goods at the place of origin or manufacture, with the addition thereto of all expenses of transportation, insurance, commission, landing, &c., incurred before entry into the Customs house in which the clearance is made.

The value of goods imported must be proved by means of an invoice made out by the manufacturer or seller, stating the real price of the goods. This invoice may, however, be replaced by a written statement.

When the invoice does not mention the expenses of transportation, insurance, commission, &c., up to the place of landing, the value thereof will be increased by 25 per cent.

The *ad valorem* duty on goods imported from foreign countries will be paid in the Lourenço Marques and Inhambane Customs in gold when the amount is not less than 2,250 reis, the value of £1 being computed at 4,500 reis both for the payment of the duty and for the declaration of value for clearance.

RHODESIA.—H.M. Trade Commissioner in Cape Town, in a recent dispatch, draws attention to the fact that Customs duty is not required to be paid on British catalogues on importation into Rhodesia. Catalogues imported into the Union of South Africa are dutiable if weighing more than 8 oz., but this duty does not apply to catalogues for Rhodesia.

SOUTHERN NIGERIA.—The Customs authorities have issued a decision permitting the free entry into that Colony of Radio fans.

BRITISH WEST INDIES.—The Board of Trade have been informed by their correspondent in British Guiana that in connection with the recent coming into force of preferential treatment of British goods, numerous proofs of origin are still being received in British Guiana, chiefly from the United Kingdom, which are not in accordance with the regulation certificate, which is uniform throughout the whole of the West Indies in which a British preferential tariff is in operation.

Furthermore, the required certificates of origin have not been furnished within the prescribed period, and as no attestation of certificates is now required in the case of goods shipped direct from the United Kingdom, the Customs authorities see no good reason why proof of origin should not be furnished at the same time as the invoices.

The Collector of Customs adds that if this state of affairs continues there will be no alternative but to insist upon the duty at the "General Tariff" rate being paid on all preferential goods unaccompanied by the statutory proof of origin at the time of importation.

In consequence of the Canadian-West Indian Reciprocal Trading Agreement of 1912, provision has been made for the entry of certain goods—the produce of the United Kingdom, Canada and Newfoundland (*a*)—at Preferential Tariff rates of duty into the following British West Indian Colonies, with effect from June 2nd, 1913:—

Trinidad and Tobago.	Leeward Islands.
British Guiana.	Antigua.
Barbados.	St. Kitts.
St. Lucia.	Dominica.
St. Vincent.	Montserrat.

For the convenience of firms shipping to the West Indies the Board of Trade have published exact forms of the certificates required, in the issue of their Journal dated December 24th.

FINLAND.—The Customs authorities have decided that mechanical apparatus for working electric lifts, not including power engines, is to be dutiable at the rate of 14·70 marks per 100 kg. (Mark = 9·6d., kilog. = 2·204 lb.).

FRANCE.—The French Customs authorities have decided that cables for electric or other purposes of iron, steel, copper, &c., wire, insulated or not, rubbered or not, with covering of aluminium spun or other, are to be dutiable as other manufactures of aluminium at the rate of 120 francs per 100 kg.

ECUADOR.—From January 1st, 1914, it has been decided to admit electric accumulators, also parts and spare parts of the same free of duty into Ecuador.

Ignition of Coal Gas.—A party of electrical and mining engineers, with Mr. Nelson, Home Office Electrical Inspector, last week carried out an experiment at the rescue station at the New Tredegar Colliery, South Wales, by which it was proved beyond question that coal gas or fire-damp could be ignited by sparks from electric signalling cables used underground.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

29,457. "Device, for preventing the clogging of sand-pipes on vehicles electrically or mechanically propelled." F. P. BOURN. December 22nd.

29,460. "Interlocking relays." H. BARKES. December 22nd.

29,474. "Construction of the heaters for electric radiators and arrangement of the resistances for display purposes." R. FIFER and D. H. JACKSON. December 22nd.

29,504. "Direct current electric engines." H. PIEPER. December 22nd. (Convention date, December 28th, 1912, Germany). (Complete).

29,519. "Telephone system of signalling from subscriber to exchange." P. J. HIME and F. M. GREEN. December 22nd.

29,526. "Device more particularly intended for use on electric light or other switches or controls for displaying reminders, advertisements, notices, and the like." E. CLARKE. December 22nd.

29,545. "Electric measuring apparatus." EVERSHED & VIGNOLES, LTD., and S. EVERSHED. December 22nd.

29,562. "Magneto electric machines." J. F. P. de la RIBOISIERE and R. LE GRAIN. December 22nd. (Convention date, December 23rd, 1912, France). (Complete).

29,566. "Incandescence lamps." J. R. QUAIN. December 22nd.

29,570. "Scales for galvanometers and the like." R. W. PAUL. December, 23rd.

29,581. "Electric bells." W. J. BLENHEIM. December 23rd.

29,582. "Method of and apparatus for the preparation of electrolytic products for deodorising, bleaching and the like." J. CALVERT. December 23rd.

29,590. "Electric cooking ovens and the like." J. P. ANNACKER. December 23rd.

29,609. "Means for effecting the gas-tight introduction of pipe conduits or electric wires into evacuated vessels or casings." A. SCHERBIUS. December 23rd. (Convention date, December 23rd, 1912, Germany). (Complete).

29,615. "Automatic or semi-automatic telephone exchange systems." GOTTHILF A. BETULANDER. December 23rd. (Convention date, December 24th, 1912, Sweden). (Complete).

29,622. "Electrical resistances." J. COLLINSON. December 23rd.

29,645. "Automatic prepayment telephone apparatus." GES. FUR ELEKTRISCHE INDUSTRIE. December 23rd. (Convention date, November 19th, 1913, Austria). (Complete).

29,655. "Machines for generating electrical energy." C. T. MASON. December 23rd. (Complete).

29,662. "Electric switches." BRITISH THOMSON-HOUSTON CO., LTD. December 23rd. (General Electric Co., United States).

29,688. "Methods of protection of electric distribution systems." F. AYTON and EVERETT, EDGCUMBE & Co., LTD. December 24th.

29,689. "Electrically actuated mechanism for controlling from a distance railway trains and other apparatus." C. WIRTH. December 24th. (Complete).

29,691. "Electric signalling." C. R. PRATT and ORLING'S TELEGRAPH INSTRUMENTS SYNDICATE, LTD. December 24th.

29,711. "Radio-telegraphic or like receiving apparatus." J. D. L. BRADWELL and G. BRADWELL. December 24th.

29,712. "Transmission of wireless signals." R. C. GALLETTI. December 24th.

29,714. "Electric cooking stoves or ranges." SIEMENS SCHUCKERTWERKE G.M.B.H. December 24th. (Convention date, December 28th, 1912, Germany). (Complete).

29,720. "Method of rendering non-conducting materials more effective for insulating purposes when they are coagulated for the services to which non-conducting materials are requisite." A. J. ROACH-CUMING. December 24th.

29,721. "Electrical switches." A. P. LUNDBERG, G. C. LUNDBERG, P. A. LUNDBERG, and G. PEGG. December 24th. (Complete).

29,734. "Dynamo construction." H. LEITNER. December 24th.

29,751. "Electric incandescent lamps." V. TERRY and E. TERRY. December 24th. (Complete).

29,752. "Electric motor control systems for trains and the like." BRITISH THOMSON-HOUSTON CO., LTD. December 24th. (General Electric Co., United States).

29,756. "Electric cables." J. F. WATSON. December 24th.

29,757. "Manufacture of electric cables." J. F. WATSON. December 24th.

29,759. "Electric railway systems and electric motor control systems." K. E. STUART. December 24th.

29,763. "Rectifier for alternating polyphase currents." SIEMENS BROS. DYNAMO WORKS, LTD. December 24th. (Siemens Schuckertwerke G.m.b.H., Germany). (Complete).

29,776. "Couplings or connections for electrical conductors." J. STONE & Co., LTD., and A. H. DARKER. December 24th. (Complete).

29,779. "Electric capstans." W. DIXON. December 24th.

29,782. "Suspension for mariners' compasses." KELVIN, BOTTOMLEY & BAIRD, LTD., and M. B. FIELD. December 24th.

29,821. "Electric switches." S. C. DAVIDSON. December 27th. (Complete).

29,822. "Electric switches." G. ELLISON and W. F. JONES. December 27th.

29,824. "Current indicating devices." F. SMITH and FERRANTI, LTD. December 27th.

29,826. "Antiseptic linings or covers for the mouthpieces of telephones and the like." MOORE, HERBERT, and MOORE. December 27th.

29,831. "Measuring instruments for Rontgen rays." R. FURSTENAU. December 27th. (Complete).

29,839. "Insulators for use on electrical circuits." T. U. FRANKUM. December 27th.

29,844. "Electrical safety and direction indicator for attaching to backs of motor-driven vehicles." L. MOORE. December 29th.

29,864. "Call registering telephone." F. D. FADER, J. TIBB, and J. W. TIBB. December 29th. (Complete).

29,883. "Automatic selecting devices for telephone systems." SIEMENS BROS. & Co., LTD. December 29th. (Siemens & Halske Akt. Ges., Germany). (Complete).

29,890. "Method of soldering metals of high melting point such as tungsten, molybdenum and the like." H. LEISER. December 29th.

29,891. "Heating body for electrical-resistance heating." H. LEISER. December 29th.

29,902. "Generation of electrical oscillations." A. F. SYKES. December 29th.

29,935. "Device for controlling the transmission of messages in a printing telegraph system." D. MURRAY. December 30th.

29,946. "Transmitting arrangements for wireless telegraphy and telephony." GRAF G. VON ARCO, and A. MEISSNER. December 30th. (Complete).

29,960. "Telephonic transmitters." A. TOOMEY. December 30th.

29,980. "Process for the production of alloys of high melting point having ductile properties." WOLFRAM LAMPEN AKT. GES. December 30th. (Convention date, August 19th, 1913, Germany). (Complete).

29,981. "Electric incandescent lamps." H. A. GILL. December 30th. (Wolfram Lampen Akt. Ges., Germany). (Complete).

29,984. "Electrical distribution systems." BRITISH THOMSON-HOUSTON CO., LTD., J. WHITCHER and E. B. WEDMORE. December 30th.

29,987. "Production of sodium and other metals from compounds thereof by electrolysis." R. J. MCNITT. December 30th. (Convention date, January 2nd, 1913, United States). (Complete).

29,997. "Sockets or fittings of electric incandescence lamps." A. HELLER. December 30th.

30,017. "Electric bells." H. C. TUDOR. December 31st.

30,034. "Method of construction of electric heating elements for use in electric radiators and the like." C. E. TURNER. December 31st.

30,044. "Electric resistances for dimming electric light." A. SCHMIDT. December 31st.

30,045. "Means for suspending overhead conductors or contact wires." SIEMENS SCHUCKERTWERKE G.M.B.H. December 31st. (Convention date, December 31st, 1912, Germany). (Complete).

30,066. "Compounds for insulating or non-conducting purposes." A. J. ROACH-CUMING. December 31st.

30,074. "Sound operated electric circuit interrupters." T. G. HODGKINSON. December 31st.

30,079. "Illuminated signs." EDISON & SWAN UNITED ELECTRIC LIGHT CO., LTD., and E. A. GIMINGHAM. December 31st. (Complete).

30,082. "Accumulators and electrodes therefor." SVENSKA ACKUMULATOR AKTIEBOLAGET JUNGNER. December 31st. (Convention date, December 31st, 1912, Sweden). (Complete).

30,083. "Electric motor control." BRITISH THOMSON-HOUSTON CO., LTD., and H. C. HASTINGS. December 31st.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

20,348. TREATMENT OF REFRACTORY MATERIALS AND APPARATUS THEREFOR. G. Weintraub and H. Rush. September 6th. (May 28th, 1912).

25,539. ELECTRIC LIGHT WIRE CASING PARTICULARLY APPLICABLE TO SHIPS' PANELLING, PARTITIONS, CEILINGS AND THE LIKE. W. G. Wakeham. November 7th.

27,923. ELECTRIC MACHINES. Soc. S.T.A.R. (Systems de Traction Auto-Regulateur). December 4th. (December 4th, 1911).

28,229. ELECTRIC LIGHTING SYSTEM. Soc. Internationale de Lumiere Froide. (Procedes Dussaud). December 6th. (December 8th, 1911). Patent of Addition not granted.

28,327. AUTOMATIC DEVICE FOR LIMITING AND REGULATING THE SPEED OF VEHICLES PROPELLED BY INTERNAL-COMBUSTION ENGINES OR BY ELECTRICITY. C. Robinson. December 9th. (Cognate Application, 4,116/13).

28,350. LUMINOUS ADVERTISEMENTS. C. Nourney. December 9th. (June 12th, 1912).

28,409. MEANS FOR CONTROLLING ELECTRIC HEATING APPARATUS. A. C. Hulbert. December 9th.

28,865. WIRELESS TELEGRAPH TRANSMITTERS. G. Marconi. December 14th. (Cognate Application, 28,866/12).

29,104. VACUUM TUBES FOR ELECTRIC LIGHTING. F. Skaupy. December 17th. (April 13th, 1912).

29,269. HIGH TENSION INSULATORS. Sir O. J. Lodge and L. Lodge. December 19th.

29,409. METHOD OF DIMINISHING THE ELECTROMOTIVE FORCES INDUCED IN THE COMMUTATION ZONES OF COMMUTATOR MACHINES. A. Heyland. December 20th. (December 20th, 1911).

29,995. ILLUMINATED SIGNS. H. L. Nicholls. December 30th.

1913.

1,600. ELECTRIC MEASURING INSTRUMENTS OF THE MERCURY MOTOR TYPE. British Thomson-Houston Co., and A. P. Young. January 20th.

6,408. PORTABLE ELECTRIC MINERS' LAMPS. P. Wolf. March 14th.

9,179. ELECTRIC SWITCHES. J. Leveque-Petit. April 18th.

9,575. MACHINES FOR WINDING OR COVERING ELECTRIC CABLES OR THE LIKE WITH TAPE OR STRIP MATERIAL. Fried. Krupp. Akt. Ges. Grusonwerk. April 23rd. (April 24th 1912).

11,208. DEVICES FOR PROTECTING TELEGRAPH AND LIKE WIRES AGAINST INDUCTIVE ACTION FROM NEIGHBOURING CIRCUITS. O. Moll and P. Kuschewitz. May 13th.

14,310. ELECTROLYTIC METERS. W. A. Childs and Reason Manufacturing Co. June 20th.

14,591. VACUUM TUBES FOR ELECTRIC LIGHTING. F. Skaupy. June 24th. (November 27th, 1912, Addition to 29,104/12).

14,710. PORTABLE LIGHT-PROJECTING APPARATUS. J. Y. Johnson (F.I.A.T. Fabbrica Italiana Automobili Torino & Soc. Anon. Officine Galileo). June 25th.

14,940. VACUUM TUBES. H. Green. June 28th.

15,097. ELECTRIC TELEGRAPH RECEIVING APPARATUS OF THE SELECTIVE TYPE. W. J. Lyons. June 30th. (Addition to 10,911/12).

15,360. PROCESS AND DEVICE FOR THE PRODUCTION OF ELECTRIC GLOW LAMP BULBS WITH REFLECTORS. Deutsche Gasgluhlicht Akt. Ges. (Auergies). July 3rd. (November 16th, 1912).

15,523. POLYPHASE ALTERNATING CURRENT SYNCHRONOUS MOTORS. Crompton and Co., and H. Burge. July 5th.

15,824. MANUFACTURE OF ELECTRIC GLOW LAMPS. Wolfram Lampen Akt. Ges. July 9th. (July 17th, 1912).

15,909. PRIMARY GALVANIC BATTERY. S. Yai. July 10th.

19,395. INTERCHANGEABLE, ALTERNATING, AND DIRECT CURRENT ELECTRIC MOTOR. H. Ashdown and F. H. Robinson. August 27th.

19,439. ILLUMINATING AND ADVERTISING DEVICES. G. Claude. August 27th.

19,783. PROCESS FOR THE PREPARATION OF ABSORBENTS TO BE USED IN THE CELLS OF ELECTRIC DRY BATTERIES. P. Rabbidge. September 1st. (September 27th, 1912).

20,318. RAILWAY ELECTRIC SIGNALS. E. O. Evans and J. B. Saunders & Co. September 9th.

20,361. SPARKING PLUGS. O. Freiburg and O. Petzsche. September 9th.